Why Do Entrepreneurs Hold Large Ownership Shares?
Testing Agency Theory Using Entrepreneur Effort and Wealth[*]

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Abstract

We augment the standard principal-agent model to accommodate an entrepreneurial setting, where effort, ownership, and firm size are determined endogenously. We test the model's predictions (some novel) using new data on entrepreneurial effort and wealth. Accounting for unobserved firm heterogeneity using instrumental variables, we find entrepreneurial ownership shares increase with outside wealth, decrease with firm risk, and decrease with firm size; effort increases with ownership and size; and both ownership and effort increase firm performance. The magnitude of the effects in the cross-section of firms suggests that agency theory is important for explaining the large average ownership shares of entrepreneurs.

Introduction

The theory of the firm has paid extensive attention to the conflict between managers and outside shareholders through the lens of moral hazard. Much theoretical work has analyzed the resolution of these conflicts through optimal contracting. Agency theory makes predictions concerning:

1. The nature of the optimal contract—the design of managerial compensation to increase the manager's incentive to maximize shareholder value.

2. The effect of the contract on the actions of managers—better aligned incentives, measured as either higher managerial equity ownership or increased pay-performance sensitivity, increase managerial effort/decrease perquisite consumption and empire building.

3. The effect of managerial actions on firm performance—higher managerial effort and lower consumption of perquisites increase firm performance.

An extensive theoretical literature examines the principal-agent problem (e.g., Holmstrom (1979), Harris and Raviv (1979), Berle and Means (1932), and Jensen and Meckling (1976)), yet evidence supporting theory's predictions is mixed and weak (e.g., Jensen and Murphy (1990), Prendergast (2002), and Himmelberg, Hubbard, and Palia (1999)). Empirical tests of agency theory have focused on the determinants of the optimal contract,[1] and on direct tests of the relation between managerial ownership and firm performance, a joint test of (2) and (3).[2]

We test the implications of agency theory applied to an entrepreneurial setting using new data on entrepreneurial effort and outside wealth. We begin by exploring the determinants of financial contracts between outside investors and entrepreneurs by augmenting the standard principal-agent model. In the model, a risk averse entrepreneur seeking financing wishes to sell part of his equity stake to outside investors who are concerned with moral hazard. The ownership structure,

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[1] The empirical literature examining the compensation contract includes Murphy (1985, 1986, 1999), Jensen and Murphy (1990), Abowd and Kaplan (1999), Gibbons and Murphy (1990, 1992), Garen (1994), Hubbard and Palia (1995), Bertrand and Mullainathan (1999, 2000, 2001), Aggarwal and Samwick (1999a, 1999b), Hall and Liebman (1998), Holderness, Kroszner, and Sheehan (1999), and Himmelberg and Hubbard (2000) among others.

[2] An extensive literature examines the relation between ownership and performance. Evidence from public firms has suggested a non-linear (somewhat hump-shaped) relation between performance and managerial ownership (e.g., Morck, Shleifer, and Vishny (1988), McConnell and Servaes (1990), Hermalin and Weisbach (1991)). Performance and ownership exhibit a positive relation for low levels of ownership, and a negative relation for high ownership levels. The former is generally interpreted as evidence of incentive alignment, while the latter is interpreted as evidence of managerial entrenchment where shareholders cannot discipline the manager. Other papers in this literature include Demsetz and Lehn (1985), Hubbard and Palia (1995), Kaplan (1989), Kole (1996), and Himmelberg, Hubbard, and Palia (1999).

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entrepreneurial effort, and size of the firm are determined endogenously. The model confirms that the standard predictions of agency theory hold in an entrepreneurial setting and are robust to endogenizing firm size. The model also generates a few novel implications, as well as quantifies the predicted effects.

We then test the model's predictions using unique data on entrepreneurs in privately held firms. The majority of papers in the literature focus on large publicly traded companies. Our private firm data offers several advantages over prior studies. First, options, long-term incentive plans, and bonuses are much less important in private firms, allowing us to focus on ownership shares. This simplifies the contracts and measures of incentives. Second, private firms provide a particularly attractive setting for testing agency theory since entrepreneurial actions are likely critical for firm success early in the firm's life cycle. Third, agency costs are likely to be especially important in private companies since there is less of an outside market for corporate control (e.g., Jensen and Ruback (1983)) to discipline manager behavior. Finally, and most importantly, our data provide previously unexplored measures of entrepreneurial effort and outside wealth. Hence, we gain a glimpse of the actions of entrepreneurs as well as their total wealth to test additional implications of the theory.

We follow a three-stage approach to testing agency theory. In the first stage we examine the nature of the optimal contract. Consistent with theory, we find that managerial equity ownership shares decline with firm risk and increase with entrepreneurial outside wealth. The latter is novel to the literature. In addition, we find that entrepreneurs optimally scale back the size of their firms dramatically in response to risk. This is evidence that size is endogenous and provides further support for agency theory since substantial scaling back should not happen if entrepreneurs did not have to retain large ownership shares (and firm risk is predominantly idiosyncratic).

In the second stage, we examine how entrepreneurs respond to the incentives provided by the contract (equity ownership). Since effort and the contract (ownership) are endogenously determined, variation in ownership shares outside of the agency model is used (including the use of instrumental variables techniques) to test these predictions. Using hours worked as a measure of entrepreneurial effort, we find that effort responds positively to ownership shares, suggesting that at least part of entrepreneurs' actions respond to the incentives provided by the contract. To our knowledge, this is the first direct evidence linking ownership to effort.

Finally, in the third stage of the analysis, we examine how both ownership and effort affect firm performance. Our analysis of firm performance differs from the literature in that we estimate production functions directly for each firm. The advantage of this more structural approach is that it is easily interpretable and provides guidance on which controls are needed in the regression. However, unobservable differences in production technologies and the contracting environment across firms can cause endogeneity problems that make detection of an effect difficult in the data. For example, if outside investors invest more heavily in the equity of better firms, entrepreneurs' equity ownership shares will be low in good firms and high in bad firms. This can spuriously cause a negative relation between ownership share and firm performance even if the causal effect is actually positive as suggested by theory. The analysis of the contract itself (stage 1) and how it influences effort (stage 2) motivates an instrumental variables approach to alleviate endogeneity problems in testing the relation to performance (stage 3). Using instrumental variables, we find that both effort and ownership have a positive effect on firm performance, providing the first direct evidence of a link between effort and performance. The effects of ownership on performance are obtained only after accounting for endogeneity of ownership using the instrumental variable approach, highlighting the importance of endogeneity.

Across the three stages, we find compelling support for agency theory's predictions. The magnitude of the predicted effects found in the cross-section of firms suggests that agency theory is important for explaining the large average equity ownership of entrepreneurs and the high concentration of entrepreneurial wealth in firm equity. More broadly, this may aid our understanding of entrepreneurial activity and economic growth. Moskowitz and Vissing-Jørgensen (2002) find that about three-fourths of all private equity is owned by individuals for whom such investment constitutes at least half of their total net worth. Moreover, around 85% of private equity is held by owners who are actively involved in the management of the firm. Our findings suggest that at least part of the concentrated ownership of entrepreneurs is driven by agency considerations. However, it is important to emphasize that tests of moral hazard focus on the incentive constraints of entrepreneurs. They do not explain the decision to become an entrepreneur initially. Hence, our results address how optimal contracting can help explain why large entrepreneur equity stakes are *maintained*, but they cannot explain the initial motivation to become an entrepreneur. Given the findings of Moskowitz and Vissing-Jørgensen (2002) that the average return to entrepreneurial investment is low given the poor diversification of entrepreneurs' wealth, the decision to become an

entrepreneur remains somewhat puzzling.

The rest of the paper is organized as follows. Section I develops an augmented model of optimal contracting theory applied to an entrepreneurial setting and derives qualitative and quantitative predictions. Section II describes the data on private firms and entrepreneurs and presents summary statistics. Section III presents our empirical results from the three stage analysis of the contract (the determinants of entrepreneurial ownership share), the response to the contract (effort), and the effect of the response to incentives on firm performance. This section highlights problems of endogeneity and how we address them. Finally, Section IV concludes.

I.   Some Theory and Structure

A.   The Agency Conflict

Entrepreneurs may be forced to hold large equity stakes in the firm for agency contracting reasons (the potential conflicts between shareholder (principal) and manager (agent) incentives). Research as early as Berle and Means (1932) recognized that when monitoring is too costly and actions are unobservable, managers may exert less effort, consume perquisites, or invest in other non-value maximizing activities (such as building empires), all to the detriment of shareholder value. Initially, we will model entrepreneurial "effort" as pertaining to all of these actions. Later, we will consider the implications of multiple dimensions of entrepreneurial actions.

The agency conflict can be resolved by giving the manager 100% equity ownership of the firm, so that he bears the entire cost of his actions, as noted by Jensen and Meckling (1976). Given the typically smaller scale of private firms this will, both theoretically and empirically, be the outcome for many such firms.[3]

A.1   The Standard Model

To illustrate the basic theory, consider the simple model of Lazear and Rosen (1981). The model describes the optimal contract between firm shareholders and a risk averse manager. Firm output is given by $Y = \mu + \varepsilon$, where μ is the entrepreneur's effort and ε is idiosyncratic firm risk. The manager's utility function is $U(c - F(\mu))$, where c is consumption, and where $U(\cdot)$ is concave, and $F(\cdot)$ convex. The contract specifies that the manager receives a fixed wage I and a share, r,

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[3]Of course, there are other mechanisms that may align managerial incentives with those of shareholders such as reputational capital, competitive labor markets, and the threat of takeover or bankruptcy. To the extent these are insufficient, the literature has viewed contracting as the most efficient mechanism to resolve the conflict. Furthermore, these mechanisms are likely to be weak in the entrepreneurial labor market and among private firms.

of output. Since the manager creates a value of Y, and free entry of firms implies zero expected profits, the expected payoff to the manager will equal the expected value of output. More formally,

$$E\left(I + rY\right) \;=\; E\left(Y\right) \tag{1}$$

$$\Rightarrow I \;=\; \left(1 - r\right)E\left(Y\right) = \left(1 - r\right)\mu. \tag{2}$$

Thus, the manager's payoff and consumption is,

$$c \;=\; I + rY = \left(1 - r\right)\mu + rY = \mu + r\varepsilon. \tag{3}$$

The manager maximizes utility, given I and r, and therefore chooses effort such that

$$F'\left(\mu\right) \;=\; r. \tag{4}$$

Knowing this, the principal (shareholders) sets r to maximize managerial utility subject to the zero profit constraint. This implies

$$r \;=\; \frac{1}{1 + R\sigma_\varepsilon^2 F''\left(\mu\right),} \tag{5}$$

where $R = -U''\left(c\right)/U'\left(c\right)$ is the absolute risk aversion of the manager.

This is the standard model used to motivate tests of optimal contracting in the literature (similar models are presented by Harris and Raviv (1979) and Holmstrom (1979)). This simple model focuses on a hired manager and gives predictions on 1) the determinants of ownership r, 2) a positive relation between effort μ and r, and 3) a positive effect on performance Y from μ. Most studies focus on stage 1, the determinants of the manager's ownership share as implied by equation (5)—specifically, the inverse relationship between risk (σ_ε^2) and ownership (r), or on the effect ownership has on firm performance (Y), a joint test of stages 2 and 3.

B. An Augmented (More Realistic) Model

We generalize the simple standard model above for several reasons. First, we augment the model to apply to an entrepreneurial setting. An entrepreneur wishes to sell part of his equity to outside investors who are concerned with moral hazard on the part of the entrepreneur. The model describes the optimal contract between potential outside equity investors and the entrepreneur, from the latter's perspective. This deviates from the standard model where outside shareholders seek to hire a manager for their firm or project, but seems more consistent with the entrepreneurial labor

market. We confirm that the main implications of the standard setting hold in the entrepreneurial setting.

Second, to take the model to the data, we add several realistic features to the basic framework above. We add capital and labor to the model to consider the role of firm size and its interaction with effort and ownership. For instance, does the negative relation between risk and entrepreneurial ownership shares implied by the standard model survive when the entrepreneur is able to scale back risky projects? If so, does theory predict a strong or weak effect? Furthermore, we employ a more realistic entrepreneur utility function to more accurately capture the trade-off between consumption and leisure. The augmented utility function allows for wealth effects on effort. Since absolute risk aversion is typically thought to be decreasing in wealth, the standard model implies a positive relation between an entrepreneur's wealth and his ownership share. However, higher wealth will also increase the desire for leisure if the utility function (unlike the one in the standard model) allows wealth effects on effort. With this more realistic utility function, we can address (and quantify) what the effect of wealth on ownership shares will be.

Third, the more realistic model can be used to provide (rough) estimates of the quantitative size of the predicted effects. This is useful for judging whether a particular qualitative prediction is likely to be detected in the data, and can be used as a rough guide for how large the effect should be. Furthermore, the more realistic setup is useful for determining whether an agency model can generate the observed large entrepreneurial ownership shares for reasonable parameterizations of the model.

Finally, we use the theoretical model to illustrate that a convincing test of the causal effect of ownership shares on effort (both endogenous variables) must rely on variation in ownership shares outside of the model. We emphasize that variation in ownership shares due to control issues provides such variation and exploit this in our empirical analysis.

B.1 Entrepreneur Preferences

The entrepreneur has the following utility function: $U\left(c, \mu\right) = \frac{1}{1-\gamma} \left(c^{\phi} \left(1 - \mu\right)^{\theta}\right)^{1-\gamma}$ where γ is the coefficient of relative risk aversion, c is consumption, $1 - \mu$ is leisure, and ϕ and θ are constants measuring the importance of consumption and leisure for utility. Managers have different outside wealth, denoted W, which affects their disutility of effort and their absolute risk aversion. We assume the manager consumes a constant fraction z of this wealth in the current period. This utility function is the standard in the literature on macroeconomic fluctuations and allows for

income/wealth effects on effort.

B.2 Production Technology

Because size empirically differs across firms, we specify output as a Cobb-Douglas production function. Thus, the entrepreneur has access to the production technology $Y = AK^\alpha L^\beta \mu^\eta$, where K is capital, L is labor, and μ is the entrepreneur's effort. The constants α, β, and η measure the sensitivity of output to each of these inputs. A is a stochastic technology shock, and is uniformly distributed $A \sim U[E(A) - \sigma, E(A) + \sigma]$. All firm risk is idiosyncratic.

Note that K and L affect the marginal product of effort and will thus affect entrepreneurial effort and ownership share. Furthermore, size will affect the optimal ownership share, and thus effort, because (dollar) risk increases in size since the technology shock enters multiplicatively.

B.3 Capital and Labor Markets

The price of the firm's output is assumed to equal 1. The firm can hire labor at the wage rate w. For simplicity we assume that the firm rents capital at a constant rate p. We could alternatively have assumed that the firm finances capital with debt but that entrepreneurs do not have limited liability. In either case, entrepreneurs will only choose plans that enable them to pay labor and capital fully for all realized values of A (to avoid zero consumption). Any debt would thus be riskless.

B.4 The Optimal Contract

The timing of the model is as follows:

1. The entrepreneur meets with potential investors (outside equity holders) and the contract is negotiated.

2. Given the contract, the entrepreneur then chooses K, L, and μ to maximize utility.

3. Uncertainty is realized and payoffs are received.

The contract simply consists of the following. The entrepreneur sells a fraction $1 - r$ of the firm to outside equity investors who receive the fraction $(1 - r)$ of firm profits after production is realized. Note that this is more realistic (particularly for the entrepreneurial setting) than the standard model, since managers typically are given a share of firm equity (and thus profits) and

not firm output. Since all firm risk is idiosyncratic, competitive capital markets imply that outside investors pay an amount $k(r)$ for the share $1 - r$ of the firm, where

$$
\begin{aligned}
k(r) &= E\left[(1-r)\,\pi\right] \\
&= (1-r)\left(E(A)\,K^\alpha L^\beta \mu^\eta - wL - pK\right).
\end{aligned} \tag{6}
$$

Thus, the only contract element for entrepreneurs and outside shareholders to negotiate is r, the fraction of equity retained by the entrepreneur.

Given $k(r)$ and r, the entrepreneur chooses his optimal effort $\mu(r)$ and the level of capital $K(r)$ and labor $L(r)$. In setting the production inputs, the entrepreneur knows $E(A)$ and σ, but does not yet know the realization of A.

After production takes place and the technology shock A is realized, the entrepreneur consumes his payoff from his equity stake in the firm

$$
\begin{aligned}
k(r) + r\pi &= (1-r)\left(E(A)\,K^\alpha L^\beta \mu^\eta - wL - pK\right) + r\left(AK^\alpha L^\beta \mu^\eta - wL - pK\right) \\
&= E(A)\,K^\alpha L^\beta \mu^\eta - wL - pK + r\left(A - E(A)\right)K^\alpha L^\beta \mu^\eta
\end{aligned}
$$

plus a constant fraction z of his outside wealth W. Notice that we do not need a separate fixed wage I as part of the compensation contract in the standard model. If the contract instead paid the entrepreneur $k^*(r)$ now plus $I + r\pi$ later, then competitive capital markets would imply that $k^*(r) = E(1-r)\pi - I$, and the entrepreneur would end up with the same amount $k^*(r) + I + r\pi = k(r) + r\pi$. Thus, the entrepreneurial setting leads to essentially the same payoff structure as the standard setting.

Given this structure, the entrepreneur sets the production inputs to solve the following maximization problem:

$$
\begin{aligned}
\max_{\mu,\,K,\,L} \quad E(U) &= E\left(\frac{1}{1-\gamma}\left(c^\phi(1-\mu)^\theta\right)^{1-\gamma}\right) \\
s.t.\ c &= k + r\left(AK^\alpha L^\beta \mu^\eta - wL - pK\right) + zW.
\end{aligned} \tag{7}
$$

The first order conditions with respect to each of the inputs $\mu(r)$, $K(r)$, and $L(r)$ are:

$$
\frac{\partial E(U)}{\partial \mu} = E\left(\left(c^\phi(1-\mu)^\theta\right)^{-\gamma}\left[\phi c^{\phi-1}(1-\mu)^\theta\, rAK^\alpha L^\beta \eta \mu^{\eta-1} - c^\phi \theta (1-\mu)^{\theta-1}\right]\right) = 0 \tag{8}
$$

$$
\frac{\partial E(U)}{\partial K} = E\left(\left(c^\phi(1-\mu)^\theta\right)^{-\gamma}\phi c^{\phi-1} r\left(A\alpha K^{\alpha-1} L^\beta \mu^\eta - p\right)\right) = 0 \tag{9}
$$

$$
\frac{\partial E(U)}{\partial L} = E\left(\left(c^\phi(1-\mu)^\theta\right)^{-\gamma}\phi c^{\phi-1} r\left(AK^\alpha \beta L^{\beta-1} \mu^\eta - w\right)\right) = 0 \tag{10}
$$

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where expectations are taken with respect to A. The dependence of $k(r)$ on the production inputs is not taken into account in deriving the first order conditions since $k(r)$ is set *before* the production inputs are chosen (this is precisely the nature of the agency problem). However, at the time of contract negotiations, both the entrepreneur and equity investors recognize the effects of the contract (r) on the entrepreneur's subsequent choice of effort. Therefore, when solving the first order conditions, we plug $k(r) = (1 - r)\left(E(A)K^\alpha L^\beta \mu^\eta - wL - pK\right)$ in the expression for consumption, c.

This structural model provides a more realistic setting to test optimal contracting theory using our entrepreneurial data. The drawback of the added structure, however, is that closed-form solutions can no longer be obtained. We solve the model numerically as follows. First, for a grid of possible values of r we solve for the values of μ, K, and L which satisfy the three first order conditions, generating functions (vectors) $\mu(r)$, $K(r)$, $L(r)$ which characterize the dependence of the production inputs on the entrepreneur's equity ownership share. Given the functions $\mu(r)$, $K(r)$, and $L(r)$, the entrepreneur's optimal value of r is then found by solving[4]

$$
\begin{aligned}
\max_r \quad E(U) &= E\left(\frac{1}{1-\gamma}\left(c(r)^\phi (1 - \mu(r))^\theta\right)^{1-\gamma}\right) \\
s.t. \ c(r) &= E(A)K(r)^\alpha L(r)^\beta \mu(r)^\eta - wL(r) - pK(r) \\
&+ r(A - E(A))K(r)^\alpha L(r)^\beta \mu(r)^\eta + zW.
\end{aligned}
\tag{11}
$$

The solution for r, and thus for μ, K, and L, and the implied value of $E(Y)$ are shown in Table I across parameter variations in the level of risk σ, background wealth consumed zW, returns to scale to K and L (α and β), the expected value of the productivity constant A, and the coefficient of relative risk aversion γ, holding all other parameters fixed. Also reported is the standard deviation across firms of the profit-to-equity ratio implied by the model. For computational ease (i.e., to avoid a three-dimensional grid search), we set $\alpha = \beta$ such that the optimal value of K and L are equal. The baseline solution sets $\sigma = 0.50$, $\gamma = 5$, $zW = 100$, $\alpha = \beta = 0.4$, and $E(A) = 2$. For all numerical solutions, the following parameters are held constant: the utility function parameters

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[4]Note that in the absence of an agency problem (i.e., if the entrepreneur and outside investors could contract directly on μ), the entrepreneur would sell all equity for the value $k(0) = E(A)(K^*)^\alpha (L^*)^\beta (\mu^*)^\eta - wL^* - pK^*$. The optimal inputs μ^*, K^*, L^* would solve the problem

$$
\begin{aligned}
\max_{\mu, K, L} \quad U &= \left(\frac{1}{1-\gamma}\left(c^\phi (1-\mu)^\theta\right)^{1-\gamma}\right) \\
s.t. \ c &= E(A)K^\alpha L^\beta \mu^\eta - wL - pK + zW.
\end{aligned}
$$

$\phi = 0.6$ and $\theta = 0.4$, the per unit costs of labor and capital ($w = p = 0.1$), and the marginal product of the entrepreneur's effort $\eta = 0.15$.

C. Empirical Predictions

Based on these numerical solutions, the model generates the following predictions:

Stage 1: The Contract

Prediction 1: *Ownership share, r, decreases with firm risk σ.*

This prediction is driven by the risk aversion of the entrepreneur. For CRRA of 5, a 40 percent increase in volatility (from 0.5 to 0.7) reduces ownership share from 56 to 34 percent, suggesting that this effect is quantitatively important. Confirming economic intuition, when volatility is small enough (approaches zero), the optimal contract entails having the entrepreneur own the entire firm. Thus, the negative relation between higher risk and ownership share survives despite the fact that the entrepreneur is able to scale back a more risky project.

The ability to scale back risky projects is interesting itself, because a model without agency problems and fully diversified investors would not generate scaling back in response to idiosyncratic risk. Hence, another testable prediction from our model that is outside of the standard setting is

Prediction 2: *Firm size decreases with firm risk σ.*

Table I indicates that this predicted effect is also quantitatively strong. Given the strong predicted relation between risk and size, and given a likely relation between ownership shares and size (see below), it will be important to control for size in empirical tests of prediction 1.

Turning to the effect of entrepreneur outside wealth on the optimal ownership share we have the following prediction.

Prediction 3: *Ownership share, r, increases with entrepreneurial outside wealth W.*

Given CRRA preferences, absolute risk aversion is decreasing in wealth. Therefore, wealthier entrepreneurs tolerate more risk and thus are willing to take higher ownership share r in order to move their effort closer to the first-best solution (i.e., in the absence of agency problems). If outside wealth is high enough, an entrepreneur will optimally own all firm equity and eliminate the

agency conflict. Note that the model preserves a positive relation between wealth and ownership even when there is a wealth effect on effort (which tends to lower effort). Note also that the effect of outside entrepreneurial wealth on r is strong enough that outside consumption zW of about a third of expected firm sales is enough to increase the optimal ownership share from 0.48 to 0.63.

The final prediction in stage 1 concerns the relation between ownership and firm size. Since firm size is endogenous, the prediction specifies the reason for size variation.

Prediction 4: *Ownership share, r, and firm size.*

1. *If differences in size across firms are driven by differences in the degree of returns to scale to capital and labor (e.g., α and β), then ownership share decreases with firm size.*

2. *If differences in firm size are driven by differences in the value of $E(A)$, then ownership share increases with firm size.*

As the production technology improves, firm size increases, and there is more risk to be shared. On the other hand, there is a wealth effect on the entrepreneur's ability to absorb risk. The net effect depends on the exact type of technology difference between small firms and large firms. Hence, the size effect on r could be either positive or negative. Note, too, that ownership share is not monotonically decreasing with risk aversion in our model. This is precisely because firm size is endogenously determined and also varies with the risk appetite of the entrepreneur.

Stage 2: Response to the Contract

Prediction 5: *Entrepreneurial effort, μ, increases with ownership share, r, when r is varied exogenously and μ, K, and L are given by the FOCs in equations (8), (9), and (10).*

Figure 1 Panel A demonstrates that effort μ is monotonically increasing in ownership share r when r is varied *exogenously* and the value of μ satisfies the first order conditions above. This is the central prediction of agency theory. However, the positive relation between ownership and effort is not necessarily true for endogenous variation in μ and r. As the results in Table I show, when considering endogenous variation in μ and r, the two are positively related in response to variation in risk and $E(A)$, but are negatively related in response to variation in background wealth and returns to K and L. This may make detection of the causal positive effect of ownership on effort

difficult. Hence, it will be important to find exogenous variation in the data that is entirely outside of the model.[5]

Similarly, Figure 1 Panel B shows that firm size—capital (K) and labor (L) inputs—increases with exogenous variation in ownership share r for values of K and L that satisfy the first order conditions.

Control issues:

One empirically important element that is left out of our model, and is therefore a candidate to generate exogenous variation in ownership, is the role of control. For instance, suppose that any majority shareholder is able to expropriate the wealth of minority shareholders. In determining the optimal contract, the entrepreneur would simply choose between keeping all of the equity, $r = 1$, or selling half to outsiders, $r = 1/2$. He would therefore solve equation (11) for $r = 1/2$ or 1. Entrepreneurs for which the optimal r without consideration of control issues is high would choose $r = 1$ when control issues are taken into account. Those with lower optimal r would choose $r = 1/2$. Figure 2 demonstrates that the majority of ownership shares in our small business data (described in the next section) occur at either 100 percent, or split evenly 50-50 between the entrepreneur and outside shareholders, suggesting that control issues are important. In this sense, control issues will provide useful variation in the data that is outside of the agency framework to test the above predictions.[6] In addition, we will also employ instrumental variables to generate exogenous variation in ownership to test these predictions.

Our model also leads to the following prediction regarding entrepreneurial effort:

Prediction 6: *Entrepreneurial effort, μ, increases with firm size, whether size variations are due to differences in α and β or due to differences in $E(A)$.*

As Table I demonstrates, when firm productivity increases (either through a higher $E(A)$ or greater

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[5]Note that ownership share cannot be instrumented by firm risk or by background wealth since background wealth has an independent effect on effort and firm risk is correlated with K and L which also have direct effects on effort since they affect the marginal product of effort. Firm risk is therefore not a valid instrument for ownership share since K and L are not instrumented for (in general, one can only instrument for one variable but not another if the instrument is not correlated with the other variable, see Appendix A and the discussion in the empirical section).

[6]More formally, Bennedsen and Wolfenzon (2000) model the optimal formation of coalitions to obtain control in an entrepreneurial setting. In their model, the entrepreneur chooses an ownership structure with multiple large shareholders (who form a coalition) to prevent a single shareholder from taking control. The model explains, for instance, why the data exhibits discrete ownership structures of 50-50 between the entrepreneur and outside shareholders versus 100 percent ownership by the entrepreneur.

marginal productivity of capital and labor inputs), the effort of the entrepreneur rises since the marginal productivity of his effort increases. This prediction, however, holds even in the absence of agency costs and therefore is not a prediction of agency theory per se.

Stage 3: Performance

Prediction 7: *Firm performance, Y, increases with entrepreneurial effort, μ.*

Although this is assumed by the model, it is also testable empirically if effort can be measured. Since prior studies have lacked data on effort, the relation between firm performance and ownership share r is typically examined (a joint test of predictions 5 and 7). Our data provides the first glimpse of actions taken by the manager in the form of hours worked.

It is worth noting, however, that theoretically entrepreneurial effort, μ, pertains to the *entire* action set of the entrepreneur. That is, the contract (ownership share) is designed to not only induce more effort from the manager, but also force him to make value-maximizing decisions (i.e., no empire building, consumption of perquisites, negative NPV projects, or hiring of unqualified family members, etc.). Since empirically we can only estimate one aspect of the entrepreneur's actions via the number of hours worked, the ownership share, r, may still provide some explanatory power for firm performance, potentially capturing the other aspects of the entrepreneur's "effort" not observable in the data. Hence, we will examine the impact on firm performance of both hours worked and ownership share simultaneously.

C.1 Multiple Dimensions of Effort

There are several interesting cases in which more can be said about multiple dimensions of effort. For example, it could be the case that longer hours by themselves are not productive, but that longer hours correlate with buying more productive assets or hiring more productive employees. More formally, suppose

$$Y = AK^{\alpha+\delta_1\mu}L^{\beta+\delta_2\mu}\mu^\eta.$$

To test whether there is any interaction between measured effort and the marginal productivity of labor and capital, we test whether δ_1 and δ_2 are significantly different from zero. Using our sample of entrepreneurs and various proxies for K, L, and μ (hours worked) described in the next section,

we run the following regression in logs

$$log(Y) = log(A) + (\alpha + \delta_1\mu)log(K) + (\beta + \delta_2\mu)log(L) + \eta log(\mu).$$ (12)

Our estimates of δ_1 and δ_2 (based on our main OLS regression in stage 3 below) are -0.058 (t-statistic = -5.54) and -0.005 (t-statistic = -0.32), respectively, and the coefficient on log hours increases when the interaction terms are included. Thus, the positive effect of hours worked on sales that we document later is not caused by omitted interaction terms, since if anything, the omitted interactions would bias our estimates downward.

Similarly, we measure μ as the hours worked by the survey respondent who owns and manages a business or by the spouse if he/she works longer hours in the business. If hours worked in the firm by the 'main' business owner in the family correlates with hours worked in the firm by the spouse, then our estimate of η will capture the effect of both responses. This does not seem to have biased our results much since our estimates in regressions involving hours (stages 2 and 3) are fairly similar when restricting the sample to businesses in which the spouse does not work in the firm.

A related issue regards productivity per hour. Entrepreneurs with better incentives would be expected to not just work longer hours but also work harder during those hours. Suppose total work effort is μe where e measures how hard the entrepreneur works. If e is positively correlated with μ then our estimate of η will tend to pick up both the effect of the longer hours and the increased productivity per hour and should be interpreted as such.

C.2 Quantifying the Predicted Effects

In addition to testing the sign of the predicted relations above, our structural approach allows us to gauge the quantitative effects of the model. Most importantly, Table I shows that the predominantly high ownership shares of entrepreneurs observed in the data can in fact be achieved in the model for quite reasonable parameterizations. However, despite the added features of realism (endogenous firm size and a more realistic utility function), our model is still very simple. The model has one period only, and assumes that A is uniform, z is exogenous, and that all entrepreneurs have unlimited liability. Therefore, we do not attempt to determine if each of the quantitative effects found in our empirical tests of the various predictions are fully consistent with the model.

D.   Previous Evidence

To our knowledge, we are the first to examine predictions 2, 3, 5, 6, and 7 directly. The data on private firms and entrepreneurs provides information on effort (hours worked) and wealth, allowing us to test these predictions. The empirical literature has tested predictions 1, 4, and the effect of ownership share (r) on firm performance (a joint test of predictions 5 and 7). The literature is divided on the empirical success of these predictions. Some argue that pay-performance sensitivity is too low to align incentives (Jensen and Murphy (1990)), while others (Hall and Liebman (1998)) disagree.

Regarding prediction 1, Garen (1994) and Aggarwal and Samwick (1999a) find that executive pay-performance sensitivity and stock ownership in large publicly traded companies decreases with measures of firm risk (stock return volatility). Core and Guay (2002) argue that this relation reverses sign when controlling for firm size. Prendergast (2002) reviews the literature and evidence on the relation between risk and incentives and concludes the evidence is weak, finding, if anything, a slight positive relation.

Pertaining to prediction 3, Jensen and Murphy (1990) and others have documented a negative relation between firm size and the ownership share of managers. Hall and Liebman (1998) find a positive relation. However, as our model (and prediction 3) indicates, the endogeneity of firm size makes this relation ambiguous.

Finally, there is an extensive literature examining the relation between ownership share and firm performance. Some find a positive relation, others argue a hump-shaped relation, and others argue no relation.[7] One of the problems in testing this relation is that exogenous variation in the firm's contracting environment can influence both the ownership level and performance simultaneously. As our augmented model highlights, the endogeneity of ownership, firm inputs, and performance can make it difficult to detect the causal relations predicted by agency theory if special attention is not paid to endogeneity. With respect to endogeneity of ownership in a performance regression, an endogeneity story not captured in our model but potentially very important is as follows. Suppose

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[7]Morck, Shleifer, and Vishny (1988), McConnell and Servaes (1990), and Hermalin and Weisbach (1991) estimate a non-linear relation between ownership and performance (Tobin's q), where performance first increases and then decreases with ownership. The former is generally interpreted as evidence of incentive alignment, while the negative relation for high ownership levels is interpreted as evidence of managerial entrenchment. Holderness, Kroszner, and Sheehan (1999) find a similar pattern in a cross-section of firms from 1935. Ang, Cole, and Wuh-Lin (2002) study a sample of small private corporations and find a positive relation between ownership and performance. Studying the same sample of firms, Nagar, Petroni, and Wolfenzon (2002) find a U-shaped relation. Himmelberg, Hubbard, and Palia (1999) and Palia (2002) argue there is no relation between ownership and performance.

firms differ in their production technologies, and outside investors invest more heavily in the equity of better firms. Then entrepreneur equity ownership shares will be low in good firms and high in bad firms, generating a spurious negative relation between ownership share and firm performance.[8] In addition to the availability of entrepreneurial effort and wealth in our data, our structural approach helps identify controls needed (e.g., size in all three stages), and points out where consideration of exogenous variation and instrumental variables is needed. This allows us to better identify the predicted relations in the data.

II. Data and Summary Statistics

We create our sample of entrepreneur equity holdings in private firms from several sources.

A. Survey of Consumer Finances

The first source for our data is the 1989, 1992, 1995, and 1998 *Survey of Consumer Finances* (SCF), which provides information on individual household portfolio composition, including investment in private firms. The surveys are samples of about 4,000 households per survey year, with household weights designed to allow aggregation to population levels. In addition to information on household assets and liabilities, the survey provides information on employment status, hours worked per week, demographics and educational attainment, as well as attributes of private firms in which the household has ownership. Although entrepreneurial hours worked are self-reported to the SCF, it is not observable to outside investors and therefore is unlikely to be biased. Although the data comes from household surveys, the SCF is considered very accurate and relatively free of biases.[9] We restrict the analysis to households who report owning private equity in a firm in which they have an active management interest (about 28% of respondents), who have positive net worth, where the entrepreneur works positive hours in the firm and is no older than 75 years, and for which the firm has positive sales and market values. Furthermore, to reduce the influence of outliers we drop firms

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[8]The importance of unobserved heterogeneity was noted by Demsetz and Lehn (1985), who argue that it can generate a spurious correlation between ownership and performance. For instance, Himmelberg, Hubbard, and Palia (1999) argue that firms with less scope for stealing or less severe moral hazard problems tend to have optimally low ownership and low performance. Ritter (1984) and Kole (1996) present a reverse causal interpretation, where performance affects ownership. Bernardo, Cai, and Luo (2001) develop a model with agency and information costs where capital constraints force the firm to pay managers of higher quality projects more performance-based compensation. Thus, managers receive greater performance-based pay because they manage higher quality projects, not that higher pay-performance sensitivity increases firm value.

[9]See Avery, Elliehausen, and Kennickell (1988), Kennickell and Starr-McCluer (1994), Kennickell, Starr-McCluer, and Sunden (1997), and Kennickell, Starr-McCluer, and Surette (2000) for a discussion of the survey and weighting schemes, as well as the SCF codebook.

which are in the bottom two or top two percentiles in terms of sales or in terms of profit/equity (in the SCF). When households are active participants in multiple companies, we examine only the firm in which they have the largest investment. We drop a small group of firms with equity shares worth 100 million or more since industry information is not available for these.

B. National Survey of Small Business Finances and Survey of Small Business Finances

We also employ a sample of small businesses, not households, in our analysis which helps alleviate possible reporting distortions and provides another source of data for robustness. This second source of entrepreneur data comes from two firm-based surveys of small businesses also sponsored by the Federal Reserve Board: the 1993 *National Survey of Small Business Finances* (NSSBF) and the 1998 *Survey of Small Business Finances* (SSBF). Both surveys provide detailed information on a sample of private, non-financial, non-agricultural businesses with fewer than 500 employees designed to represent the population of about 5 million small firms in the U.S. The 1993 NSSBF covers 4,637 small companies in operation as of December, 1992, while the 1998 SSBF covers 3,561 firms in existence at the end of December, 1998. About 90% of these firms are managed by the principal shareholder. The surveys detail the demographic and financial characteristics of the firms and their principal equity holder.[10]

For our purposes, the key differences between the SCF and small business surveys are that the former contains hours worked by the entrepreneur and entrepreneur net worth. The NSSBF does not contain either of these variables, and the SSBF contains only limited data on the principal shareholder's net worth. However, the NSSBF and SSBF provide a larger, more comprehensive sample of small business finances, performance, and ownership structure. We employ both data sets for robustness.

C. Summary Statistics

Table II reports summary statistics of our sample of entrepreneurs and privately held firms. Panel A pertains to the data from the SCF and Panel B to the small business surveys. As the first row of each panel indicates, ownership is highly concentrated. The entrepreneur is typically the principal shareholder, holding over 80% of the firm's equity on average across both data sets. Figure 2 plots the distribution of equity ownership for our sample of entrepreneurs. Around 63% of entrepreneurs

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[10]For more information about the NSSBF and SSBF see Elliehausen and Wolken (1990), Cole and Wolken (1995), and Bitler, Robb, and Wolken (2001). Our sample criteria are as described above for the SCF.

own the entire firm, with another 10% owning exactly 50% of the equity.[11] The remaining 27% of entrepreneurs are distributed more evenly across ownership shares. Figure 3 shows that the 100% owners are concentrated among smaller firms as measured by asset size and number of employees. As alluded to earlier and emphasized by Nagar, Petroni, and Wolfenzon (2002), the spikes at 50% and 100% ownership shares are evidence of the importance of control rights in small firms. We will use the variation in ownership share from this clustering to generate movement in ownership outside of the agency framework.

We focus on hours worked (available in the SCF only) in the firm in which the household has its largest actively managed ownership share. Entrepreneurial hours worked in this firm are self-reported hours per week (a) in the person's main job if the person reports working in the firm and being self-employed, or (b) in the person's second job if the person reports working in the firm and is not self-employed but has an own business as a secondary job. If both the head of household and spouse have positive entrepreneurial hours in the firm, we take the maximum of those hours.[12]

On average, entrepreneurs put in about 45 hours per week, with an interquartile range of 30 hours. Comparing only full-time workers, the median (mean) number of hours worked by full-time self-employed heads of household is 50 (53) compared to 40 (46) for full-time heads of household who work for someone else. Also recorded is the total net worth of entrepreneurs. The mean entrepreneur has $865 thousand of wealth, the median has about $269 thousand. Since the small business surveys contain limited information on net worth in 1998 only, we primarily focus on the wealth figures from the SCF.[13]

Finally, both panels report statistics on entrepreneur age, demographics, education, and experience (defined as years of full-time employment, including self-employment, in the SCF, and defined as years of managing or owning a business, including the current business, in the NSSBF/SSBF). Also reported are summary statistics on the firms themselves. The sample is composed of propri-

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[11]Since we do not use the SCF and NSSBF/SSBF sample weights in the subsequent analysis, the histograms are based on the unweighted data in order to best show the amount of variation in ownership shares we use. The percentage of entrepreneurs with 100% ownership shares is slightly higher when weighting the data.

[12]One could consider using the sum of the hours when both work in the firm. We did not do this since one may be worried that a positive relation between ownership and hours in stage 2 would be driven by spouses working in 100 percent family owned firms and that this may not be motivated by agency theory. As mentioned previously, our results involving hours in stages 2 and 3 are robust to excluding firms where both the respondent and the spouse work in the firm.

[13]Clearly, entrepreneurs tend to be among the wealthiest households, as documented in a host of studies (e.g., Meyer (1990), Dunn and Holtz-Eakin (1995), Quadrini (1999), Gentry and Hubbard (1999), Heaton and Lucas (2000), and Hurst and Lusardi (2001)). However, there is ample variation in the wealth of entrepreneurs as well as in the fraction of net worth tied to the firm. On average, about 40% of an entrepreneur's total wealth is tied up in firm equity, see Gentry and Hubbard (1999) and Moskowitz and Vissing-Jørgensen (2002).

etorships and partnerships as well as S and C corporations. While proprietors and partnerships outnumber S and C corporations, the two comprise about the same total value. Prior studies that employ the small business data (e.g., Ang, Cole, and Wuh Lin (2000) and Nagar, Petroni, and Wolfenzon (2002)) focus exclusively on C corporations. The justification given for excluding S corporations, proprietorships, and partnerships are complications in comparing operating expenses across organizational form due to varying tax motivations and other considerations. Since we do not focus on expenses and efficiency ratios as these studies do, but rather estimate the production function itself, we abstract from these complications and allow a more comprehensive study of all private businesses. In addition, use of the SCF data in testing contracting theory in private firms is unique.

III. A Three Stage Analysis: Ownership, Effort, and Performance

Our empirical tests are organized in three stages: 1) what determines ownership across firms, 2) how ownership affects effort, and 3) how ownership and effort affect firm performance.

A. Stage 1: The Contract—What Determines Entrepreneurial Ownership?

We begin by analyzing the contract itself—what determines ownership shares? Table III reports regression results with entrepreneur equity ownership shares (percentage of firm equity owned by the household) as the dependent variable. Panel A contains results from the SCF and Panel B from the NSSBF/SSBF. In the SCF, we average the data across imputations before performing any calculations. The regressions are run using OLS or 2SLS (two-stage least squares) with robust standard errors that account for heteroscedasticity and cross-correlated errors. Dummies for year, industry, education, gender, and race/ethnicity are included (since they may affect the production technology and thus the optimal contract) but are omitted from the table for brevity.[14]

A.1 Risk and Ownership

We begin by testing prediction 1, that entrepreneurial equity ownership shares decrease in firm risk. To construct a measure of firm risk, we run a cross-sectional regression of firm profit-to-equity ratios on a constant and variables useful for taking out predictable differences in profit-to-equity ratios. These controls are year dummies, a set of firm characteristics: log of number of employees,

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[14]All results are robust to weighting and accounting for sampling design in the NSSBF/SSBF and to adjusting for multiply-imputed data in the SCF.

log of total equity value, firm age and age squared, industry dummies[15], and a set of entrepreneur characteristics: two education dummies for having some college education and for having a college degree, a dummy for being male, three race/ethnicity dummies for Asian, Hispanic, or African American, measures of experience, and finally dummies for how the firm was acquired (founded or inherited). In the SCF we also include two additional experience controls, a dummy for whether the entrepreneur ever had a full-time job with a different employer that lasted three years or more, and a dummy for having previously been self-employed for three years or more in a different business. The absolute value of the residual from this regression is used as a proxy for firm risk, denoted σ. In regressions involving this risk variable, we drop observations in the top two percent of the distribution (this corresponds to values of σ above 3, or 300 percent).

Column 1 of Table III reports OLS coefficient estimates of ownership share on σ, the set of firm controls (production inputs and firm age which may affect the production function), a set of entrepreneurial variables, which include the log of outside wealth (i.e., wealth not tied to the firm) as well as controls for disutility of effort (age, age squared), the dummies for how the firm was acquired (more on these below), as well as the year dummies and dummies for entrepreneurial education, gender, and ethnicity mentioned above. Consistent with prediction 1, the coefficient on σ is negative and significant. The economic effects of risk on ownership share are non-negligible, but small. Moving from the 10th percentile of σ (0.064) to the 90th percentile of σ (0.885) reduces the ownership share by only 4 percentage points.

Column 5 of Table III repeats the same regression using the 1998 SSBF data. The regressors are the same except total assets is used as a measure of firm size instead of total equity, and profits to assets is used for constructing the risk measure.[16] Again, a negative and statistically significant effect of σ on ownership share is observed. The effect of risk is smaller in the small business survey data, however.[17]

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[15]The 1989 public use version of the SCF records 26 categories for the type of business the entrepreneur works. However, after 1989, the public use version of the SCF only records seven broad categories for line of business. These are roughly 1) farming, 2) contracting, construction, mining, oil and gas, 3) manufacturing, arts and crafts, 4) restaurants, direct sales, gas stations, food/liquor stores, other retail/wholesale, 5) auto repair, real estate, insurance, entertainment, various business services, banking and financing, 6) professional practices, beauty shops, trucking, repairs, personal services, management and consulting services, communications, writing services, transportation, educational services, and 7) other. In the NSSBF/SSBF industry categories are defined based on two-digit SIC codes.

[16]The NSSBF and the SSBF only has book equity measures, and these are negative for substantial fractions of the samples.

[17]The smaller effects in the NSSBF/SSBF may be related to the fact that the ownership measure in these surveys may be more noisy since information about ownership shares is for the "principal shareholder" of the firm who may or may not be a manager. Although we restrict the NSSBF/SSBF to firms in which the manager is an owner, there may

Since the measure of firm risk we employ is undoubtedly very noisy, we supplement the analysis with instrumented measures of firm risk designed to reduce the errors-in-variables problem. Columns 2–4 of Table III (Panel A) and 7–10 (Panel B) report two-stage least squares estimates, where firm risk σ is first predicted in a first stage OLS regression using various instruments, and the predicted σ is then used as a regressor in the second stage ownership regression. For the SCF data (Panel A), two sets of instruments are employed for risk. The first is a set of industry dummies and the second is a dummy for whether the entrepreneur used personal assets as collateral for the business. The first stage regressions also include all of the other regressors used in the second stage.

Panel C reports the coefficient estimates and t-statistics of the instruments (coefficient estimates on the other regressors are omitted for brevity) along with R^2 and p-values of F-statistics on the joint significance of the instruments. As indicated in Panel C, the instruments are successful in capturing cross-sectional variation in σ. The collateral dummy is negatively associated with risk, most likely because entrepreneurs in risky firms are not willing to post personal assets as collateral. When using instrumented σ (with either the industry or collateral dummies), the effect on ownership share in the second stage is magnified. With the industry instruments, the estimated coefficient on firm risk jumps by a factor of almost six to -0.274. Thus, a move from the 10th percentile of σ to the 90th percentile of σ now reduces the ownership share by about 22 percentage points, which is more in line with the large economic effects of firm risk on ownership share suggested by our model (see Table I). Using the collateral dummy instrument increases the coefficient to -1.297. Both of these are statistically significant. The instrumental variable estimation using industry dummies is overidentified—the $N \times R^2$ chi-squared overidentification test rejects the null of orthogonality of the instruments and the error term. Fortunately, however, the coefficient on σ from the estimation using industry dummies is similar to the coefficient obtained using different instruments in the NSSBF/SSBF, which is reassuring.

Columns 7 and 9 of Panel B demonstrate that the effect of risk in the NSSBF/SSBF data also increases when instrumental variables are employed. In the small business survey data two sets of instruments for risk are used. The first is two dummy variables indicating whether the firm has exports or whether the firm primarily sells its products in the same area as the firm's main office (the omitted dummy is for those firms without exports and who sell mainly regionally or nationally in the U.S.) and the second is the number and number squared of R&D employees (available only

be some cases where the principal shareholder is not a manager. Thus, we expect to find weaker results regarding the ownership variable throughout the analysis when comparing NSSBF/SSBF estimates to those in the SCF.

in the 1993 NSSBF). Both sets of instruments are significant in the first stage and we fail to reject the overidentification test in the second stage for the export/local dummies (we do not show an overidentification test for the number of R&D employees variables since that model is overidentified only because of the squared R&D term). Across both data sets, therefore, risk is negatively related to ownership share, and the economic magnitude of the effect improves with the use of instrumental variables.

To illustrate the effect on the risk coefficient of controlling for firm size, columns 4, 6, 8, and 10 shows regressions which exclude our measures of $ln(K)$ and $ln(L)$. Recall that our model provides another mechanism by which entrepreneurs can reduce their risk exposure. Rather than taking a lower ownership share, entrepreneurs may simply scale back the firm (reduce K and L). Hence, leaving out firm size measures may make it difficult to identify the relation between ownership share and risk in the data. Column 4 of Panel A highlights this for the SCF, since when log of equity and log of employees are excluded, the significance of σ on ownership drops substantially. The importance of controlling for firm size is even more apparent in the NSSBF/SSBF (Panel B), where excluding firm size results in a *positive* relation between risk and ownership, under both OLS and two-stage instrumental variables regressions. As Prendergast (2002) notes, the evidence on the relation between risk and incentives is mixed. One possible explanation for this disparity may be variation in the controls for size used across studies.[18]

A.2   Discussion of Instrumental Variables Approach

Before proceeding, we should point out a potential problem with our instrumental variables estimations. In stage 1 (ownership) we instrumented for firm risk, in stage 2 (effort) we will instrument for ownership share, and in stage 3 (sales) we will instrument for hours worked and ownership share. At the same time, we include firm size controls (measures of $ln(K)$ and $ln(L)$), but do not instrument for these. In each stage it is possible that size is correlated with the error term because technology differences across firms unobserved to us, but perhaps observed by the firm itself, enter the error terms. This is most apparent in stage 3 where we will estimate the production function directly. Since we do not have good instruments for firm size, the question remains under what conditions will we get consistent estimates of the effects of other variables which we do instrument for, when

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[18]In fact, a recent paper by Core and Guay (2002) argues that the negative relation between ownership and risk documented by Aggarwal and Samwick (1999a) is overturned when controlling for firm size. Our model provides a theoretical argument for why this may be the case, and our empirical results highlight the importance of accounting for firm size.

we do not instrument for size? What is required is a zero covariance between the instruments and firm size (for reference, we provide a brief proof in Appendix A). When the covariance is non-zero, it is in general impossible to sign the bias generated by not instrumenting for size. We believe our instrumental variables estimation of the effect of hours in stage 3 (the production function) will be the least affected by this potential problem, however, because we instrument hours worked by entrepreneur age, which, after controlling for firm age, is only very weakly related to firm size. Furthermore, we will instrument ownership share by two additional instruments in stages 2 and 3, one of which (a dummy for having inherited/been given the firm) has a much weaker relation to firm size than the other (a dummy for having founded the firm). The coefficient estimates are not sensitive to which of these instruments is used, suggesting that correlation of instruments with firm size does not substantially bias the coefficient on ownership share in stages 2 and 3. Potential biases due to correlation of instruments and firm size is more of a concern in stage 1, where all of the instruments used are correlated with size to varying extents. However, it is comforting to note that three of four instrumental variables estimations in stage 1 lead to quite similar coefficients on risk across two different data sets.

A.3 Wealth and Ownership

Prediction 3 states that ownership increases with the wealth of the entrepreneur. Table III shows that the coefficient on log of outside wealth is positive and significant both in the SCF and even in the 1998 SSBF for which lower quality wealth data is available (households are asked for very detailed wealth categories in the SCF, but are only asked for their home equity and the total net worth of other non-firm assets in the SSBF). The economic effect of outside wealth on ownership share is quite large. Moving from the 10 percentile in the distribution of non-firm wealth (around 73,000 dollars) to the 90th percentile (around 15 million dollars) increases the ownership share by around 11 percentage points.

However, note once again the importance of firm size. If we exclude proxies for K and L in the regression, the coefficient on wealth becomes *negative* and significant. Controlling for firm size is critical, therefore, for identifying a wealth effect on ownership, since the choice of firm size is another mechanism to control risk.

A.4 Size and Ownership

As for prediction 4, ownership share is ambiguously related to firm size according to our theory. As Table III indicates, empirically there is a negative relation between size and ownership share, both when measured by number of employees and by total firm equity or assets.

A.5 Scaling Back Firm Size in Response to Risk

Of more interest and importance is the endogenous role firm size plays. The ability to scale back risky projects is interesting itself. Because a model without agency problems and fully diversified owners would not generate scaling back in response to idiosyncratic risk, the negative relation between size and risk is a testable prediction of our agency model (prediction 2).

Table IV reports results from regressions of firm size variables: capital (K) and labor (L) inputs, on our measures of firm risk (controlling for a host of firm production and entrepreneur characteristic variables). Both OLS and two-stage least squares instrumental variables regressions are reported (instrumenting for risk) across the SCF (Panel A) and NSSBF/SSBF (Panel B) data sets. For both OLS and various instrumental variables regressions, the effect of risk on firm size is negative and significant. Once again, the magnitude of the effect is amplified when using the instruments, with coefficients varying between -4 and -10 for labor and between -6 and -10 for capital. These are large effects since the 10th–90th percentile range is around 5 for $ln\,(L)$ and around 6 for $ln\,(K)$.

B. Stage 2: Response to the Contract—How Does Ownership Affect Effort?

We provide the first direct evidence of entrepreneur actions in response to incentives using a measure of entrepreneur effort—hours worked. Prediction 5 states that effort increases with ownership share, for exogenous variation in ownership share. We test this prediction by regressing the number of hours worked per week by the entrepreneur on his ownership share. However, since ownership and effort are endogenously determined, we need to control for firm heterogeneity or find exogenous variation in ownership shares. We employ the firm production variables and entrepreneur characteristics as regressors to control for observable differences across firms and entrepreneurs. To account for unobservable firm (and entrepreneur) heterogeneity, however, we need most of the remaining variation in ownership to be exogenous, or we need to generate exogenous variation in ownership via instrumental variables. We examine both.

B.1 OLS Estimates

First, as mentioned previously, control issues in private firms provide variation in ownership shares that is outside of the agency framework. Since a large fraction of the cross-sectional variation in ownership shares is generated from control (according to Figure 2 and evidence in Nagar, Petroni, and Wolfenzon (2002)) an OLS regression likely identifies the causal effect of ownership share on effort.

The first column of Table III shows that effort is positively related to ownership shares (controlling for firm production and entrepreneur characteristics). Moving from 50% to 100% ownership share increases effort by about 3.4 hours per week.

B.2 Instrumental Variables

Second, we employ instrumental variables to generate exogenous variation in ownership shares. Finding instruments for ownership share that are otherwise unrelated to effort is no easy task. In particular, because we do not instrument for K and L we must find variation in ownership that is also uncorrelated with these firm inputs. This, for instance, rules out firm risk σ as a potential instrument. Also, entrepreneur outside wealth is not a valid instrument since it affects the disutility of effort and therefore directly affects the dependent variable. Given these constraints, we employ two dummy variables for how the entrepreneur acquired the firm. The first is a dummy for having inherited/been given the firm and the second is a dummy for having founded the firm (the omitted category consists of those who purchased the firm). Entrepreneurs who have been given or have inherited their ownership share will likely have lower ownership shares on average since they often will have siblings or other relatives with whom to split firm equity. This source of variation in ownership shares should be unrelated to the production technology or firm inputs and otherwise unrelated to effort. Similarly, non-founders are likely to have lower ownership shares since sale of the firm typically is only possible when the firm has a sufficient track record for outsiders to evaluate the firm. Given such a track record, attracting equity investors will tend to be easier, leading to a lower ownership share.[19]

Panel B of Table V reports the results from the first stage of the instrumental variables estimations. The significance of the coefficients on the inherited/given and founder dummies, the F-statistic on their joint significance, and the R^2 indicate that these instruments capture substan-

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[19]Excluding the founder dummy and simply using the inherited dummy to instrument for ownership provides similar results.

tial variation in ownership shares.

Column 2 of Panel A Table V reports the results from the second stage regression of effort on instrumented ownership share. An entrepreneur with a 100% ownership share is now predicted to work about 6.3 hours more per week than an entrepreneur with a 50% ownership share, and similar coefficient estimates are found using either of the two instruments separately. Once again, accounting for endogeneity with instrumental variables strengthens the coefficient estimates. Overidentification tests further support the use of our instruments for ownership share.

B.3 A Non-Monotonic Relation Between Ownership and Effort?

Some studies have argued that a non-linear relation between ownership and managerial actions (and therefore performance) exists (e.g., Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990)). The third column of Table V examines the non-linear relation between ownership share and effort by splitting ownership levels into four dummy categories: ownership between 0 and 50%, exactly 50%, greater than 50 but less than 100%, and equal to 100%. The omitted dummy in the regression is the 100% ownership category. As the table indicates, we find a monotonic relation between ownership shares and effort.

B.4 Robustness

The last four columns of Table V present results for various subsamples of the data or alternative specifications for robustness. Column 4 reports results for only those entrepreneurs with active management equity shares in a single firm. This rules out the concern that households with active management equity shares in multiple firms (36% of those with any active management equity shares) may spend the majority of their hours working in other firms with lower equity stakes. The relation between ownership and hours is similar when excluding these households. Column 5 reports results for households who work at least 20 hours per week. The estimated coefficient on ownership is slightly lower, but still highly significant. Due to the presence of outliers in the hours data, column 6 reports results for median (least absolute deviation) regressions. The results are similar. Finally, column 7 reports results excluding all households where the spouse also works in the firm. Once again, the effect of ownership share on effort is robust.

B.5   Size and Effort

Although not a unique prediction of agency theory, prediction 6 states effort and firm size should be positively related. Table V shows clear evidence that firm size and effort move together. Since this is not unique to agency theory per se and since we do not instrument for L and K, this evidence can simply be viewed as entrepreneurial hours increasing when the marginal product of effort increases.

Finally, it is important to emphasize that hours worked is only one dimension of entrepreneurial effort. The positive correlation between ownership and effort may be indicative of many other managerial actions that also increase firm value, but which we cannot observe in the data. The effect on hours may thus be indicative of a larger overall effect of equity ownership shares on the incentives of the entrepreneur. This will imply a larger effect of effort on firm performance than the above estimates may suggest. In addition, this indicates that both effort and ownership may be useful in explaining firm performance since our measure of effort only captures one piece of entrepreneurial actions. We investigate this in the next subsection.

C.   Stage 3: Performance—Do Ownership and Effort Affect Firm Performance?

One of the critical implications of agency theory is prediction 7: that the inducement of managerial effort and alignment with shareholder interests has a direct impact on firm value. If agency costs are significant, then hours worked and, if hours are not a sufficient statistic for effort or other managerial actions, ownership share should be positively related to firm performance. We provide the first evidence linking effort to firm performance.

Prior studies examine the relation between ownership and performance, a joint test of predictions 5 and 7. These studies typically regress ratios of profitability on ownership shares or pay-performance sensitivity. Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) regress Tobin's q and the profit-to-equity ratio of firms on ownership shares and other firm ratios. Ang, Cole, and Wuh Lin (2000) regress efficiency ratios (operation expenses-to-sales and sales-to-assets) on ownership shares and other firm characteristics. However, these tests are difficult to interpret. First, the results are often sensitive to whether the scaling variable (denominator) in the dependent variable appears on the right hand side of the regression. More importantly, however, is the fact that compensation contracts (ownership) and entrepreneur responses to those contracts (effort) are endogenously determined by the production technology and other aspects of the contracting environment (e.g., ease of monitoring), which differs across firms. As illustrated by our

theory, this will make detection of a relation between ownership and performance or effort and performance difficult. For example, Table I shows how differences in the degree of returns to scale in K and L lead to a negative relation between output and ownership share and that differences in entrepreneurial outside wealth lead to large variation in ownership shares with little effect on output.

We take a simpler approach and estimate the firm's production function directly. This directly assesses whether higher entrepreneurial hours worked and/or higher entrepreneurial ownership share lead to higher output (sales). In addition to being easier to interpret, another advantage is that the production function immediately suggests which controls are needed on the right hand side of the regression and helps determine what constitutes valid instruments for hours worked and ownership share.

Consider the simple Cobb-Douglas production function from Section I.A,

$$Y_t = A_t K_t^\alpha L_t^\beta \mu_t^\eta$$
$$\Leftrightarrow ln(Y_t) = \alpha ln(K_t) + \beta ln(L_t) + \eta ln(\mu_t) + ln(A_t). \tag{13}$$

Our measure of output, $ln(Y_t)$, is the log of sales. We will also employ the log of profits to capture potential effects on costs.[20] We employ the log of the number of employees for labor input and log of total equity (in the SCF) or total assets (in the NSSBF/SSBF) for firm capital. As in stage 2, entrepreneur weekly hours worked are used as a measure of effort, μ. If we allow the ownership share, r, to have a multiplicative effect in the production function (assuming hours worked is not sufficient for μ) it enters linearly in the log linearized equation so that

$$ln(Y_t) = \alpha ln(K_t) + \beta ln(L_t) + \eta ln(\mu_t) + \delta r_t + ln(A_t). \tag{14}$$

The endogeneity problem is clear from this relation. If the technology shock is time-varying but is observed before K, L, μ, and r are set, then all the right hand side variables will be correlated with the error term leading to inconsistent coefficient estimates when estimating via OLS. Similarly, problems arise if technology is constant across time but not across firms and one estimates the coefficients based on a cross-sectional regression (as we do here). In the cross-sectional setting, one would expect endogeneity to bias the estimates of α, β, and γ upwards since theory predicts that they will be positively correlated with the technology parameter $ln(A_t)$ which enters the error term.

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[20]This is somewhat less satisfactory since firms with negative profits are dropped and since the correct functional form is less apparent.

C.1 Endogeneity

Several different approaches have been used to address endogeneity. One solution is to try to 'satiate' the regression with as many firm and entrepreneur attributes as is available (e.g., Demsetz and Lehn (1985), Himmelberg, Hubbard, and Palia (1999)). We adopt this approach for our first set of tests.[21] Another approach is to use firm fixed-effects estimation to difference out the unobservables (e.g., Himmelberg, Hubbard, and Palia (1999), who find no relation between ownership and performance using this approach). However, fixed-effect estimations impose strong assumptions on the unobservables (time-invariance) and eliminate cross-sectional information. If unobservables are time varying, a fixed-effects approach may even pick up predominantly endogenous variation. For example, if an entrepreneur works longer hours this year than last, presumably a leading explanation for this is that his hours are more productive than they were last year. In this case, hours correlate with the productivity of hours over time and a fixed-effects regression would not be able to determine whether it is increased productivity of the initial hours or the additional hours that affect the outcome (sales/profits, etc.). A way out of this identification problem is to make the indirect inference that if additional hours did not affect the outcome, then entrepreneurs would likely know this and would not have worked longer hours. Thus, either more hours worked lead to better outcomes or entrepreneurs allocate effort believing this to be true. Since we do not have panel data, fixed-effects estimation is not possible, and therefore we focus exclusively on instrumental variables estimation to address endogeneity.

Valid instruments that are correlated with ownership and effort, but otherwise uncorrelated with the production technology, are often difficult to find. For example, some studies use sales as an instrument in regressions with Tobin's q as the dependent variable. Since market value depends on sales, there is likely to be a direct effect of sales on q, thus invalidating this instrument. Others use lagged explanatory variables as instruments, which (as Himmelberg, Hubbard, and Palia (1999) argue) are also not likely to be valid. Attributes of the entrepreneur such as entrepreneur experience or education (which directly affects the marginal product of labor and thus should be included as regressors) employed by Palia (2002), for instance, may be equally invalid. In addition, since we do not instrument for K or L, the instruments for μ and r should be uncorrelated with K and L

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[21]Notice that market equity likely is a good proxy for the unobserved technology parameter. If so, then using market equity as our measure of capital in the SCF may implicitly help to alleviate potential endogeneity problems (of course the coefficient on $\ln(K)$ then does not have a structural interpretation, but this coefficient is not a main focus of the analysis).

as discussed earlier (see Appendix A).

However, theory provides some guidance on the choice of instruments. Variables that affect the disutility of effort (and the derivatives of this function) and are not related to K and L serve as valid instruments for hours as well as ownership share in the performance regressions. This is because such variables are unlikely to have a direct effect on the production function.[22] The variables we employ as instruments for effort are therefore the entrepreneur's age (and age squared). Since entrepreneur age is correlated with the entrepreneur's experience running the firm (a variable that likely affects firm performance) it is important to control for experience when using age as an instrument. Therefore, we employ the same experience controls as in earlier regressions. We instrument for ownership share using the two dummies for how the entrepreneur acquired the firm (the founder dummy and the dummy for having inherited/been given the firm).

C.2   Controlling for Observables

Our data set affords us a wealth of observable characteristics (particularly about the entrepreneur) to help mitigate endogeneity, many of which have not been available in prior studies. The idea is to saturate regression equation (13) with variables which affect the production function and thus would otherwise enter the error term. We run the following regression,

$$ln(Y_t) = E(A) + \alpha ln(K_t) + \beta ln(L_t) + \gamma ln(\mu_t) + \sum_{e=1}^{E} \gamma_e Z_{e,t} + \delta r_t + \sum_{j=1}^{J} \delta_j F_{j,t} + ln(\epsilon_t) \qquad (15)$$

where $\sum_{e=1}^{E} Z_{e,t}$ are a set of entrepreneur characteristics, namely experience, dummies for education, race/ethnicity, and gender, and $\sum_{j=1}^{J} F_{j,t}$ are a set of firm characteristics, which includes firm age and age squared, as well as industry dummies. $ln(\epsilon_t)$ is the log of the remaining unexplained part of the technology parameter A. For brevity, we do not report the coefficient estimates on the education, race/ethnicity, gender, industry, and year dummies.

Table VI reports regression results for the cross-sections of firms in the SCF data. The first column of Panel A of Table VI estimates equation (15) using OLS with robust standard errors that account for heteroscedasticity and cross-correlated error terms. The effect of log entrepreneurial hours on log of sales is positive and statistically significant. There is a positive but insignificant

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[22]Heterogeneity in the disutility of providing effort does raise one possible concern. For instance, if entrepreneurs with low disutility of effort choose to work in or start firms where the marginal product of labor is high, then we may find that additional hours worked increase firm performance even if higher productivity per hour worked is the cause of this increase. What can be said in the face of such endogenous matching is that either extra hours do lead to better outcomes or entrepreneurs allocate their hours in ways suggesting that they think hours lead to better outcomes.

coefficient on ownership share. Columns two and three show that the coefficient on log hours is marginally larger when leaving out ownership share and vice versa. Panel B of Table VI repeats the above regressions using log of profits as the dependent variable. The results are similar for effort, but ownership is negatively related to profitability.

Table VII conducts the same analysis on the small business survey data (the NSSBF and SSBF). Panel A contains the results for log sales and Panel B for log profits. Hours worked by the entrepreneur are not recorded in these data sets, so the focus of the OLS regressions here is on the ownership share of the manager. The first column of both panels indicates no evidence of a positive relation between ownership and performance, with the coefficient on ownership in the sales regression being significantly negative.

The results on the effects of ownership share on sales and profits are weak or counter to the theoretical prediction. However, it is difficult to determine causality if unobserved technology differences between firms remain. For instance, entrepreneurs in poorly performing firms may be forced to hold larger equity stakes, since other investors are unwilling to hold shares in lower quality companies. Furthermore, since hours may be correlated with unobserved (to us) differences in technologies, the positive effect of hours on sales and profits could be spurious. Thus, we turn to instrumental variables estimation.

C.3 Controlling for Unobservables

To control for unobservable technology differences across firms, we employ instrumental variables for entrepreneurial hours and ownership share. As Panel C of Tables VI and VII attest, the instruments are successful in capturing cross-sectional variation in effort and ownership. Hours are significantly related to age but not to the acquisition dummies (note that this helps validate the use of the acquisition dummies as instruments in the stage 2 hours regressions). Ownership share is significantly related to both age and acquisition dummies in the SCF but is more weakly related to these instruments in the NSSBF/SSBF data. The tests of overidentifying restrictions support use of the instruments.

The small business survey data do not contain hours worked by the entrepreneur. Since, however, it does contain the variables with which we instrument hours in the SCF, we run two-sample instrumental variables regressions, where we use the coefficients on the instruments for hours in the SCF to project predicted hours in the small business data using the instruments available in the NSSBF/SSBF data. Details of the two-sample instrumental variables procedure are provided

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in Appendix B.

The last column of Panels A and B of Table VI reports the effect of instrumented ownership and effort on log sales and log profits, respectively, from the SCF data. The last column of Panel A demonstrates a larger and still significant effect of instrumented effort on sales compared to the OLS regressions. More dramatically, the effect of the entrepreneur's ownership share on sales is much more positive and is significant at the 10 percent level. This is striking given that the non-instrumented ownership share had a very small and insignificant effect on sales. In Panel B, the results for firm profits are similarly much more in accordance with agency theory when instrumenting. The instrumented SCF results show that once exogenous variation in effort and ownership share are employed, both effort and ownership have larger positive effects on profits that are statistically significant. Once again, the magnitude of the estimated effects is enhanced by instrumenting. Most compelling is the switch from a negative to a statistically significant positive effect from ownership share when instrumenting.

We also note that these results are robust for subsamples of the data that include only those entrepreneurs with active management equity shares in a single firm, only those who work at least 20 hours per week, and excluding those whose spouse also works in the firm.

Table VII reports similar findings for the small business survey data. The second and fifth columns instrument for ownership share only. The third and sixth columns employ a two-sample instrumental variables regression for hours worked, where the coefficient estimates on the instruments from the first stage hours regression in the SCF (where hours worked are available) are applied to the same instruments in the small business data to predict hours. These regressions do not instrument for ownership share. Consistent with prediction 7, both ownership share and predicted hours worked (effort) have a large, positive, and significant impact on sales and profits, respectively. Compared to OLS estimates, instrumenting makes a dramatic difference. The coefficient on ownership share, for instance, switches from significantly negative under OLS to significantly positive when instrumenting. This, again, stresses the importance of endogeneity. Once exogenous variation in ownership and effort is employed (via instrumental variables), we find a strong positive relation to firm performance, consistent with agency theory's predictions.

Overall, we find fairly strong evidence supporting agency theory's predictions across two data sets. Controlling for unobserved heterogeneity in the firm's production and contracting environment is critical in testing these predictions.

Finally, we should emphasize that our approach in stage 3 does in fact test agency theory as opposed to signaling theory. While both agency and signaling predict a positive relation between ownership share and firm performance, only *unpredictable* (by investors) variation in ownership can be used to signal to investors, while both predictable and unpredictable variation in ownership shares matters for performance according to agency theory. In our stage 3 regressions, since we instrument for ownership share, we thus relate the *predicted* component of ownership share to performance, which is consistent with agency not signaling theory.

IV. Concluding Remarks

Employing a structural model augmented to fit the entrepreneurial labor market and using a unique sample of private firms, we test the implications of agency theory. We split the analysis into three stages:

1. What determines the entrepreneur's equity stake?

2. How does the entrepreneur respond to the incentives provided by the contract?

3. How is firm performance related to the response and incentives of the entrepreneur?

We present the first direct evidence of the effect of entrepreneur wealth on the contract in stage 1. We also present the first direct evidence of entrepreneur actions (hours worked) in response to the contract in stage 2. Further, by estimating production functions directly and employing instrumental variables to generate exogenous variation in effort and ownership, we find evidence in stage 3 that both effort and ownership increase firm output. Given the weak/perverse results obtained when not instrumenting, endogeneity is clearly an important issue affecting these tests.

Given the support for agency theory predictions across all three stages of the analysis and across two different data sources, we conclude that agency theory is important for explaining the cross sectional variation in entrepreneur ownership shares, effort, and performance. Therefore, it is likely that agency considerations—the provision of incentives to exert effort and not consume perquisites—are a key driver explaining why entrepreneurs on average hold large equity ownership shares.

However, while agency costs may help explain why managers need to hold large equity shares in the firm, conditional on entry into entrepreneurship, they cannot explain the entry decision. Given the seemingly unattractive private equity risk-return trade-off documented by Moskowitz

and Vissing-Jørgensen (2002) (caused by the large equity ownership shares and the resulting large amounts of idiosyncratic risk taken on), the decision to become an entrepreneur remains a puzzle. Other considerations such as large non-pecuniary benefits to owning and running the firm, preferences for skewness in the return distribution, and overoptimism and misperceived risk may be important for understanding entrepreneurship, economic growth, and household investment. We leave these issues for future study.

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Appendix A: Validity of Instruments for Ownership and Effort When Capital and Labor Are Endogenous

Consider a model of the form $y = x_1\beta_1 + x_2\beta_2 + \varepsilon$, where both x_1 and x_2 are correlated with ε, and y, x_1, and x_2 are $N \times 1$ vectors. We are interested in determining under what conditions the coefficient on a variable x_1 is consistently estimated by an instrumental variables estimation if x_1 is instrumented by a variable z_1 which is correlated with x_1 and uncorrelated with ε, but x_2 is not instrumented for. Let $\beta = \begin{bmatrix} \beta_1 & \beta_2 \end{bmatrix}'$, $X = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$, and $W = \begin{bmatrix} z_1 & x_2 \end{bmatrix}$. Then

$$\widehat{\beta}_{IV} = (W'X)^{-1} W'y = \begin{bmatrix} z_1'x_1 & z_1'x_2 \\ x_2'x_1 & x_2'x_2 \end{bmatrix}^{-1} \begin{bmatrix} z_1'y \\ x_2'y \end{bmatrix} = \beta + \begin{bmatrix} z_1'x_1 & z_1'x_2 \\ x_2'x_1 & x_2'x_2 \end{bmatrix}^{-1} \begin{bmatrix} z_1'\varepsilon \\ x_2'\varepsilon \end{bmatrix}$$

and $\widehat{\beta}_{1,IV} \xrightarrow{p} \beta_1$ requires that $\frac{z_1'x_2}{N} \xrightarrow{p} 0$.

Appendix B: Two-Sample Instrumental Variables Estimation

Our two-sample instrumental variable estimates follow Angrist and Krueger (1995), and correct the standard errors in the second stage for the first stage estimation. We use the following set of instrumental variables to predict hours: the owner's age and age squared and dummy variables for how the owner acquired the firm. Regressions pool the 1992 and 1998 SCF to estimate the first stage and pool the 1993 and 1998 small business data to estimate the second stage.

In order to satisfy the conditions for the estimator to be consistent, the two samples must be drawn from the same population. Since the small business data cover only small businesses and non-farm, non-financial, private, for-profit firms, we must exclude firms not eligible for the small business survey from the sample of SCF firms for estimation of the first stage.

The SCF data contains only a very broad measure of industry. The seven industry categories available consistently in the 1998 and 1992 SCF (based on underlying three-digit Census industry codes) were matched to the 1987 two-digit SIC code data released with the SSBF/NSSBF. Then, industry categories seven (government) and one (fishing, forestry, agriculture) were dropped. Firms with more than 500 employees were also dropped. Since Hispanic ethnicity and race are two separate questions in the SSBF/NSSBF (e.g., a SSBF/NSSBF firm can have owners who are either Hispanic or not Hispanic and any race) while Hispanic ethnicity and each racial categories are mutually

exclusive in the SCF, we recoded small business firms that were Asian and Hispanic or Black and Hispanic in the SSBF/NSSBF to be only Hispanic. Furthermore, we restricted the first stage to the 1992 and 1998 SCF (or the 1998 SCF) to better match the population from which the sample of firms in the 1998 and 1993 SSBF/NSSBF were drawn. Also, the second stage is restricted to firms where the largest owner is no older than 75 years. Finally, since the measure of equity—market equity—in the SCF is not available in the NSSBF/SSBF, and since the measure of book equity which is in the NSSBF/SSBF is negative for about one-fourth of the firms in the small business data which we did not want to drop from the sample, we instead use assets as a measure of size in the second stage regressions. The relevant first stage for these regressions is similar to row one of Panel C of Table VI, but restricts the sample as described above.

There are some issues in matching these two samples. The SCF firms could be any firm that the person is actively involved in managing while the small business firms have information for the largest owner who may not be the manager. There are also a small number of industries that could be sampled for the SCF but were ineligible for the SSBF. These industries are in a broad SCF industry category mainly full of firms eligible for the SSBF and thus should not cause substantial problems. Finally, race and ethnicity in the small business data are not for any specific owner unless the firm only has one owner; rather the small business data asks if the race (ethnicity) of more than 50% of the share holders was black, Asian or other non-white (Hispanic). Again since most firms have very few owners, we expect this not to affect the determination of race or ethnicity of the owners of many small business firms.

Table I:
Numerical Solutions to the Augmented Model

Reported below are numerical solutions for the augmented structural model of Section I.B and the solution to equation (11):

$$\max_{r} \quad E(U) \quad = \quad E\left(\frac{1}{1-\gamma}\left(c\left(r\right)^{\phi}\left(1-\mu\left(r\right)\right)^{\theta}\right)^{1-\gamma}\right)$$

$$s.t.\ c\left(r\right) \quad = \quad E\left(A\right)K\left(r\right)^{\alpha}L\left(r\right)^{\beta}\mu\left(r\right)^{\eta} - wL\left(r\right) - pK\left(r\right) + r\left(A - E\left(A\right)\right)K\left(r\right)^{\alpha}L\left(r\right)^{\beta}\mu\left(r\right)^{\eta} + zW.$$

for a variety of parameter combinations. The solution for entrepreneur ownership share r, entrepreneur effort μ, capital and labor inputs K and L, the implied value of expected output Y, and a measure of risk which is the standard deviation of the profit-to-equity ratio ($\sigma(\pi/Eq)$) are reported across parameter variations in the level of risk σ, background wealth consumed zW, production function coefficients on labor (α) and capital (β) (e.g., returns to scale to L, K), expected value of the productivity constant A, and the coefficient of relative risk aversion γ, holding other parameters fixed. For computational ease and to avoid a three-dimensional grid search, the level and productivity of capital and labor are set equal to each other (i.e., $\alpha = \beta$ and $K = L$). The baseline solution sets $\sigma = 0.50$, $\gamma = 5$, $zW = 100$, $\alpha = \beta = 0.4$, and $E(A) = 2$. For all numerical solutions, the following parameters are held constant: the utility function parameter constants $\phi = 0.6$ and $\theta = 0.4$, the per unit costs of labor and capital (w and p) are set equal to 0.1, and the marginal product of the entrepreneur's effort η is set equal to 0.15.

	$\phi = 0.6,\ \theta = 0.4,\ w = p = 0.1,\ \eta = 0.15$				
	Ownership	Effort	Size	Output	Risk
	r	μ	$K = L$	Y	$\sigma(\pi/Eq)$
Baseline	0.56	0.287	7,235	582	0.126
$\sigma = 0.5,\ \gamma = 5,\ zW = 100,$					
$\alpha = \beta = 0.4,\ E(A) = 2$					
Risk					
$\sigma = 0.7$	0.34	0.169	4,561	383	0.171
$\sigma = 0.3$	0.86	0.444	12,457	854	0.085
Background Wealth					
$zW = 0$	0.48	0.288	7,236	583	0.126
$zW = 200$	0.63	0.285	7,229	580	0.126
$zW = 800$	1.00	0.258	7,134	547	0.130
Returns to Scale/Productivity of Inputs					
$\alpha = \beta = 0.41$	0.49	0.293	22,325	1,661	0.133
$\alpha = \beta = 0.39$	0.68	0.280	2,867	249	0.119
$\alpha = \beta = 0.38$	0.89	0.269	1,320	123	0.114
Production Function Constant					
$E(A) = 1.5$	0.58	0.180	1,171	96	0.165
$E(A) = 2.5$	0.65	0.366	28,700	2,182	0.105
Risk Aversion					
$\gamma = 3$	0.61	0.327	8,944	663	0.133
$\gamma = 7$	0.54	0.266	6,168	531	0.120
$\gamma = 9$	0.56	0.265	5,461	509	0.114

Summary Statistics on Entrepreneurs and Private Firms

Reported below are summary statistics of private equity ownership, entrepreneur effort (hours worked per week), characteristics of entrepreneurs, and attributes of the private firms. Panel A reports summary statistics for the SCF—*Survey of Consumer Finances* (averaged across the four survey years—1989, 1992, 1995, and 1998), which provides household level data on private equity ownership. The numbers tabulated refer to the firm in which the household has its largest actively managed ownership share. Panel B reports summary statistics for the 1993 NSSBF—*National Survey of Small Business Finances*, and the 1998 SSBF—*Survey of Small Business Finances*, which pertains to firm level data in samples of private firms with fewer than 500 employees. Reported are the mean, median, 25th and 75th percentiles, minimum and maximum, and standard deviation of the variables. Also reported are the percentage of firms which are proprietorships and partnerships (P&P), S and C corporations (S&C), and the percentage of entrepreneurs with some college education and with a college degree, as well as gender and ethnicity information. All statistics shown are based on the samples used in our regressions. The summary statistics are calculated using survey weights in order to be representative of the underlying population.

Panel A: Entrepreneur-Level Data								
(Survey of Consumer Finances (SCF) 1989-1998)								
	Mean	Median	25%	75%	Min	Max	Stdev	
%Own	84.8%	100%	72.4%	100%	0.6%	100%	26.9%	
Effort (hours/week)	45.1	48	30	60	1	133	21.1	
Sales ($,000)	$937	$78	$21	$250	$0.9	$148,000	$5,798	
Profits ($,000)	$155	$19	$4	$63	-$1,000	$120,000	$1,277	
Equity ($,000)	$638	$80	$25	$250	$0.3	$998,000	$4,716	
# Employees**	10.7	3	1	6	1	3,500	51.9	
Net Worth* ($,000)	$865	$269	$110	$713	$1.1	$370,000	$2,979	
Firm Age	11.0	8	3	16	0	63	10.2	
Entrepreneur Age	45.3	44	37	53	20	75	11.6	
Experience	20.8	20	12	30	0	61	13.1	
	P&P	S&C	Some College	College Grad	Male	African American	Hispanic	Asian
% Sample	76.7%	23.3%	25.4%	38.6%	80.1%	3.3%	3.2%	4.3%

Panel B: Firm-Level Data								
(Survey of Small Businesses NSSBF 1993, SSBF 1998)								
	Mean	Median	25%	75%	Min	Max	Stdev	
%Own	83.4%	100%	51%	100%	1%	100%	24.8%	
Assets ($,000)	$343	$65	$20	$223	$0.02	$100,000	$1,303	
Sales ($,000)	$732	$168	$60	$500	$2.5	$32,000	$2,179	
Profits ($,000)	$91	$22	$2.3	$65	-$37,800	$31,900	$546	
Book Equity ($,000)	$145	$23	$2.9	$99	-$41,000	$87,000	$968	
# Employees**	8.1	4	2	7	1	500	19.2	
Net Worth*,† ($,000)	$573	$245	$102	$565	$0.0	$115,000	$2,194	
Firm Age	13.4	11	6	18	0	216	10.9	
Entrepreneur Age	49.1	49	41	56	19	75	10.5	
Experience	18.1	16	10	25	0	55	10.4	
	P&P	S&C	Some College	College Grad	Male	African American	Hispanic	Asian
% Sample	55.2%	44.8%	25.0%	46.5%	78.6%	3.4%	5.1%	3.9%

** Including the entrepreneur.

* Excludes equity in the firm.

† Only available in the 1998 SSBF.

Table III:
What Determines Entrepreneur Equity Ownership Shares? (Stage 1)

Cross-sectional regressions of entrepreneur equity ownership shares on various firm and entrepreneur characteristics are reported below. Panel A reports results for the 1989, 1992, 1995, and 1998 *Survey of Consumer Finances* (SCF). The regressors include a measure of firm risk: the absolute value of the residual of the profit rate (profits/equity) after regressing it on year dummies and a set of firm and entrepreneur attributes. This risk measure is also instrumented with (1) industry dummies, (2) a dummy for whether the entrepreneur is using personal assets as collateral for the business, (3) dummies for whether the firm has exports or its sales are concentrated locally, and (4) the amount and amount squared of number of R&D employees. Overidentification tests are shown at the bottom of Panels A and B. Also included as regressors are a measure of entrepreneur outside wealth: log of net worth not held as firm equity, various firm characteristics: the log of firm market equity, log of number of employees, firm age and age squared, as well as various entrepreneur characteristics: age and age squared, years of full time work experience, dummies for whether the entrepreneur has worked in another job for three years or more as an employee (one dummy) or as self-employed (another dummy), and dummies for how the firm was acquired (a founder dummy and a dummy for having inherited/been given the firm), for gender, education, and ethnicity, and for industry and year. Panel B reports results for the 1993 *National Survey of Small Business Finances* (NSSBF) and 1998 *Survey of Small Business Finances* (SSBF). Market equity estimates are not available for these data. We therefore use assets as a size measure. All regressions are run using robust standard errors that account for heteroscedasticity and cross-correlated errors (*t*-statistics in parentheses). The coefficients on the gender, education, ethnicity, experience dummies, and year dummies are omitted from the table for brevity, along with the constant term. Panel C reports the results from the first stage of the instrumental variables regressions, along with *p*-values of the *F*-statistics on the joint significance of the instruments. Only the coefficient estimates on the instruments are reported for brevity.

	Dependent Variable = Ownership Share of Entrepreneur									
	Panel A: SCF (1989-1998)				**Panel B: NSSBF/SSBF (1993-1998)**					
					1998		1993-1998		1993	
Regression:	OLS	IV$^{(1)}$	IV$^{(2)}$	IV$^{(2)}$	OLS	OLS	IV$^{(3)}$	IV$^{(3)}$	IV$^{(4)}$	IV$^{(4)}$
Firm Variables:										
σ	-0.048	-0.274	-1.297	-0.276	-0.016	0.010	-0.181	1.375	-0.201	0.151
	(-3.69)	(-4.21)	(-2.24)	(-1.50)	(-3.45)	(2.16)	(-1.51)	(1.38)	(-1.21)	(0.35)
ln(Size)†	-0.049	-0.077	-0.184		-0.031		-0.073		-0.067	
	(-11.55)	(-8.95)	(-2.91)		(-7.48)		(-2.04)		(-1.66)	
ln(Employees)	-0.040	-0.023	0.028		-0.058		-0.025		-0.029	
	(-8.38)	(-3.66)	(0.85)		(-11.14)		(-1.13)		(-1.30)	
Firm Age	0.010	0.010	0.012	0.005	0.003	0.002	0.001	0.005	0.001	0.000
	(6.10)	(6.14)	(3.60)	(2.54)	(1.99)	(1.24)	(1.76)	(1.06)	(1.29)	(0.08)
(Firm Age)^2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-4.15)	(-4.47)	(-3.00)	(-2.27)	(-1.69)	(-1.54)	(-1.59)	(-0.72)	(-1.33)	(-0.53)
Entrepreneur Variables:										
ln(Wealth)	0.020	0.022	0.037	-0.044	0.008	-0.025				
	(5.20)	(5.17)	(3.00)	(-4.69)	(2.09)	(-3.63)				
Age	0.007	0.003	-0.015	0.011	0.004	0.007	0.003	-0.008	0.005	-0.002
	(1.68)	(0.58)	(-1.13)	(2.12)	(0.92)	(1.52)	(0.84)	(-0.53)	(1.09)	(-0.25)
(Age)^2	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000	0.000
	(-1.84)	(-0.72)	(1.09)	(-1.73)	(-1.25)	(-1.45)	(-1.09)	(0.49)	(-1.17)	(0.31)
Experience	0.001	0.001	0.000	0.000	0.004	0.001	0.004	0.020	0.004	0.003
	(2.67)	(2.05)	(-0.02)	(0.03)	(1.94)	(0.46)	(2.72)	(1.33)	(1.91)	(0.51)
Founded	0.080	0.091	0.152	0.155	-0.008	0.043	-0.018	-0.159	-0.025	-0.018
	(6.20)	(6.13)	(3.42)	(6.82)	(-0.54)	(2.82)	(-1.95)	(-1.20)	(-2.04)	(-0.38)
Inherited	-0.082	-0.071	-0.039	-0.089	0.009	-0.007	0.016	-0.177	0.006	-0.037
	(-3.32)	(-2.71)	(-0.79)	(-3.04)	(0.34)	(-0.25)	(0.69)	(-1.32)	(0.24)	(-0.92)
R^2	0.307				0.269	0.094				
Observations	*2,643*	*2,643*	*2,643*	*2,643*	*2,129*	*2,129*	*6,063*	*6,063*	*3,319*	*3,319*
Over ID test		5.260					0.000	0.232		
(*p*-value)		(0.000)					(0.995)	(0.630)		

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				Panel C: 1st Stage Instrumented Regressions for Risk, σ				
IV Regression	Ind1	Ind2	Ind3	Ind4	Ind5	Collateral	R^2	p-value
(1) σ	0.238	0.108	0.039	0.124	0.242		0.243	0.000
	(6.77)	(3.59)	(1.41)	(4.66)	(8.94)			
(2) σ						-0.041	0.244	0.000
						(-2.43)		

	Exports	Local	R&D	$(R\&D)^2$	R^2	p-value
(3) σ	0.097	-0.050			0.251	0.013
	(1.60)	(-2.19)				
(4) σ			0.018	-0.0002	0.226	0.025
			(2.66)	(-2.51)		

[†] Firm size is market value of equity for the SCF and total assets for the NSSBF and SSBF.

Table IV:
How Does Risk Affect Firm Size?

Cross-sectional regressions of firm size (ln(Employees), ln(Equity), and ln(Assets)) on risk measures are reported below. Panel A reports results for the 1989, 1992, 1995, and 1998 *Survey of Consumer Finances* (SCF). Panel B reports results for the 1993 *National Survey of Small Business Finances* (NSSBF) and 1998 *Survey of Small Business Finances* (SSBF). The regressors include a measure of firm risk: the absolute value of the residual of the profit rate (profits/equity) after regressing it on year dummies and a set of firm and entrepreneur attributes. This risk measure is also instrumented with a dummy for whether the entrepreneur is using personal assets as collateral for the business, dummies for whether the firm has exports or its sales are concentrated locally, and the amount and amount squared of number of R&D employees. Overidentification tests are shown at the bottom of the table. Also included as regressors are a measure of entrepreneur outside wealth: log of net worth not held as firm equity, various firm characteristics: firm age and age squared, as well as various entrepreneur characteristics: age and age squared, years of full time work experience, dummies for whether the entrepreneur has worked in another job for three years or more as an employee (one dummy) or as self-employed (another dummy), and dummies for how the firm was acquired (a founder dummy and a dummy for having inherited/been given the firm), for gender, education, and ethnicity, and for industry and year. Panel B reports results for the 1993 *National Survey of Small Business Finances* (NSSBF) and 1998 *Survey of Small Business Finances* (SSBF). Market equity estimates are not available for these data. We therefore use assets as a size measure. All regressions are run using robust standard errors that account for heteroscedasticity and cross-correlated errors (*t*-statistics in parentheses). The coefficients on the gender, education, ethnicity, industry, and year dummies are omitted from the table for brevity, along with the constant term. Panel C reports the results from the first stage of the instrumental variables regressions, along with *p*-values of the *F*-statistics on the joint significance of the instruments. Only the coefficient estimates on the instruments are reported for brevity.

	Panel A: SCF (1989-1998)				Panel B: NSSBF/SSBF (1993-1998)					
Dependent	ln(Employees)		ln(Equity)		ln(Employees)			ln(Assets)		
Variable:	L		K		L		1993	K		1993
Regression:	OLS	IV$^{(1)}$	OLS	IV$^{(1)}$	OLS	IV$^{(2)}$	IV$^{(3)}$	OLS	IV$^{(2)}$	IV$^{(3)}$
Firm Variables:										
σ	-0.163	-4.316	-0.576	-7.016	-0.130	-4.738	-9.600	-0.495	-5.869	-8.679
	(-2.51)	(-4.62)	(-6.79)	(-5.29)	(-7.68)	(-3.95)	(-2.72)	(-21.41)	(-4.13)	(-2.56)
Firm Age	0.064	0.037	0.104	0.061	0.013	0.003	0.003	0.023	0.012	0.016
	(6.83)	(2.54)	(8.31)	(2.99)	(3.71)	(0.38)	(0.16)	(5.59)	(1.10)	(0.99)
(Firm Age)^2	-0.001	-0.001	-0.002	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-3.73)	(-2.58)	(-5.18)	(-3.37)	(-0.82)	(-0.58)	(-0.85)	(-1.89)	(-1.10)	(-1.30)
Entrepreneur Variables:										
Age	0.025	-0.008	0.051	0.000	0.003	0.032	0.336	0.015	0.049	0.294
	(1.17)	(-0.21)	(1.70)	(-0.01)	(0.23)	(0.64)	(2.19)	(0.78)	(0.83)	(2.09)
(Age)^2	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.003	-0.000	-0.000	-0.003
	(-1.19)	(0.03)	(-1.20)	(0.12)	(-0.93)	(-0.63)	(-2.23)	(-1.32)	(-0.81)	(-2.15)
Experience	0.012	0.003	0.010	-0.003	0.046	-0.021	-0.093	0.055	-0.023	-0.068
	(3.56)	(0.63)	(2.37)	(-0.43)	(6.92)	(-0.74)	(-1.33)	(6.28)	(-0.70)	(-1.06)
Founded	-0.725	-0.242	-0.652	0.098	-0.394	-0.237	0.405	-0.638	-0.456	0.100
	(-9.47)	(-1.51)	(-6.79)	(0.42)	(-9.11)	(-1.71)	(1.04)	(-11.22)	(-2.78)	(0.28)
Inherited	-0.012	-0.121	0.328	0.160	0.192	0.859	1.063	0.277	1.055	0.999
	(-0.08)	(-0.61)	(1.92)	(0.61)	(2.18)	(2.68)	(1.66)	(2.44)	(2.77)	(1.74)
R^2	0.215		0.289		0.201			0.294		
Observations	*2,664*	*2,664*	*2,664*	*2,664*	*6,063*	*6,063*	*3,319*	*6,063*	*6,063*	*3,319*
Over ID test						0.023			0.518	
(*p*-value)						(0.879)			(0.472)	
Panel C: 1st Stage Instrumented Regressions for Risk, σ										

IV Regression	Collateral	Exports	Local	R&D	(R&D)^2	R^2	*p*-value
(1) σ	-0.110					0.185	0.000
	(-5.97)						
(2) σ		-0.013	0.100			0.099	0.000
		(-0.19)	(3.95)				
(3) σ				-0.013	0.000	0.069	0.088
				(-1.79)	(0.79)		

How Do Ownership and Size Affect Entrepreneurial Effort? (Stage 2)

Cross-sectional regressions of self-reported hours worked per week by the entrepreneur on the entrepreneur's equity ownership, outside wealth, and firm size are reported below. Data are taken from the 1989, 1992, 1995, and 1998 *Survey of Consumer Finances*. Focusing only on the firm in which the household has its largest actively managed ownership share, hours worked are those (a) in the person's main job if the person reports working in the firm and being self-employed, or (b) in the person's second job if the person reports working in the firm and reports not being self-employed but owning a business as a secondary job. If both the head of household and spouse have positive entrepreneurial hours in the firm, the maximum is taken. Ownership is the percentage of firm equity owned by the entrepreneur (Own). We also instrument ownership using dummies for how the entrepreneur acquired the firm (a founder dummy and a dummy for having inherited/been given the firm). Ownership is also expressed in terms of ranges as dummies for those who own less than 50% of the firm, those who own exactly 50%, and those who own greater than 50%, but less than 100% of the firm. Also included as regressors are measures of the entrepreneur's disutility of effort (age, age squared), year dummies, and various firm attributes (firm age, firm age squared) and entrepreneur attributes (experience controls, and dummies for gender, education, and ethnicity) which may affect the production technology. Regressions are estimated via OLS and least absolute deviation (LAD) models (*t*-statistics in parentheses). Regressions are also reported for subsamples that include only entrepreneurs involved in a single firm, only those who work at least 20 hours, and only those whose spouse does not work in the firm. The dummy coefficients are omitted from the table for brevity, along with the constant term. Panel C reports the results from the first stage of the instrumental variables regressions, along with *p*-values of the *F*-statistics on the joint significance of the instruments. Only the coefficient estimates on the instruments are reported for brevity.

Panel A: Dependent Variable = Entrepreneurial Effort (Hours Worked per week)						
				1 Firm	> 20 Hours		No Spouse
Regression:	OLS	IV	OLS	OLS	OLS	LAD	OLS
Own	6.854	12.647		7.746	4.409	4.908	5.577
	(5.62)	(1.70)		(4.65)	(4.05)	(3.98)	(4.16)
Own$_{[0,50)}$			-5.048				
			(-5.13)				
Own$_{[50]}$			-3.916				
			(-3.25)				
Own$_{(50,100)}$			-3.030				
			(-2.53)				
Firm Variables:							
ln(Equity)	1.582	1.848	1.589	1.831	0.767	1.204	1.396
	(5.77)	(4.37)	(5.79)	(5.18)	(3.09)	(4.97)	(4.66)
ln(Employees)	0.688	0.968	0.644	0.847	0.850	0.785	0.636
	(2.29)	(2.01)	(2.16)	(2.09)	(3.07)	(2.80)	(1.97)
Firm Age	0.148	0.090	0.151	0.134	-0.061	0.050	0.135
	(1.38)	(0.69)	(1.40)	(0.96)	(-0.59)	(0.51)	(1.16)
(Firm Age)^2	-0.002	-0.001	-0.002	-0.002	0.002	0.000	-0.002
	(-0.77)	(-0.39)	(-0.79)	(-0.57)	(0.95)	(-0.09)	(-0.83)
Entrepreneur Variables:							
ln(Wealth)	-0.970	-1.092	-0.939	-0.899	-0.729	-0.659	-0.696
	(-3.76)	(-3.69)	(-3.63)	(-2.67)	(-3.21)	(-2.76)	(-2.44)
Age	0.527	0.490	0.514	0.613	0.584	0.189	0.369
	(1.85)	(1.70)	(1.81)	(1.77)	(2.22)	(0.76)	(1.19)
(Age)^2	-0.011	-0.011	-0.011	-0.012	-0.012	-0.009	-0.010
	(-4.22)	(-4.02)	(-4.18)	(-3.66)	(-4.56)	(-3.71)	(-3.37)
Experience	0.533	0.525	0.536	0.525	0.418	0.546	0.552
	(16.84)	(15.85)	(16.96)	(12.59)	(13.15)	(17.49)	(16.70)
$R^{2\dagger}$	0.227	0.221	0.227	0.235	0.177	0.138	0.247
Observations	*2,698*	*2,698*	*2,698*	*1,721*	*2,471*	*2,698*	*2,067*
Over ID test		0.020					
(*p*-value)		(0.984)					

Panel B: 1st Stage Instrumented Regressions for Ownership				
IV Regression	Founded	Inherited	R^2	*p*-value
Own	0.080	-0.081	0.308	0.000
	(6.23)	(-3.28)		

Table VI:
Do Ownership and Effort Affect Firm Performance? (Stage 3)
Evidence from the *Survey of Consumer Finances*

Cross-sectional regressions of two firm performance measures (log of sales—Panel A and log of profits—Panel B) on measures of entrepreneur ownership shares and effort plus firm and entrepreneur characteristics are reported below. The data are from the 1989, 1992, 1995, and 1998 *Survey of Consumer Finances*. Managerial effort is the weekly hours worked by each entrepreneur, defined as in Table V. Regressions are estimated using OLS with robust standard errors that account for residual heteroscedasticity and cross-correlations (t-statistics in parentheses). Regressions are also estimated via instrumental variables estimation (two-stage least squares). In the 2SLS regressions ownership and effort are instrumented by dummy variables for how the firm was acquired (a founder dummy and a dummy for having inherited/been given the firm), and the entrepreneur's age and age squared. Overidentification tests and p-values are reported at the bottom of the table. All regressions include dummies for industry, year, entrepreneur gender, education, and ethnicity, as well as experience dummies. The coefficients on these variables are omitted from the table for brevity, along with the constant term. Panel C reports the results from the first stage of the instrumental variables regressions, along with p-values of the F-statistics on the joint significance of the instruments. Only the coefficient estimates on the instruments are reported for brevity.

Dependent Variable:	Panel A: ln(Sales)				Panel B: ln(Profits)			
Regression:	OLS	OLS	OLS	IV[1]	OLS	OLS	OLS	IV[1]
ln(Effort)	0.197	0.202		0.331	0.180	0.172		0.370
	(4.56)	(4.70)		(2.31)	(3.72)	(3.55)		(2.21)
Own	0.124		0.165	1.697	-0.222		-0.188	1.265
	(1.30)		(1.73)	(3.31)	(-1.73)		(-1.46)	(1.83)
ln(Equity)	0.528	0.523	0.535	0.580	0.550	0.559	0.557	0.601
	(29.33)	(30.07)	(29.73)	(21.88)	(25.92)	(26.63)	(26.17)	(18.04)
ln(Employees)	0.548	0.543	0.551	0.623	0.229	0.239	0.231	0.295
	(23.64)	(23.67)	(23.66)	(17.95)	(7.51)	(8.18)	(7.59)	(6.56)
Firm Age	0.043	0.045	0.044	0.024	0.016	0.014	0.017	-0.001
	(6.19)	(6.43)	(6.31)	(2.62)	(1.93)	(1.66)	(2.03)	(-0.12)
(Firm Age)^2	-0.001	-0.001	-0.001	-0.001	0.000	0.000	-0.001	0.000
	(-6.04)	(-6.17)	(-6.41)	(-3.27)	(-2.42)	(-2.27)	(-2.68)	(-0.71)
Experience	-0.002	-0.002	0.000	-0.006	-0.009	-0.010	-0.007	-0.014
	(-0.95)	(-0.90)	(0.23)	(-2.03)	(-3.54)	(-3.64)	(-2.80)	(-3.66)
R^2	0.782	0.782	0.780	0.754	0.573	0.573	0.571	0.543
Observations	*2,719*	*2,719*	*2,719*	*2,719*	*2,523*	*2,523*	*2,523*	*2,523*
Over ID test				0.110				0.000
(p-value)				(0.978)				(1.000)

Panel C: 1st Stage Instrumented Regressions for Ownership and Effort

IV Regressions	Founded	Inherited	Age	(Age)^2	R^2	p-value
(1) ln(Effort)	0.016	-0.062	0.005	0.000	0.213	0.000
	(0.61)	(-1.07)	(0.49)	(-2.71)		
(1) Own	0.082	-0.083	0.010	0.000	0.300	0.000
	(6.37)	(-3.37)	(2.69)	(-2.58)		

Table VII:
Do Ownership and Effort Affect Firm Performance? (Stage 3)
Evidence from the *Small Business Surveys—NSSBF and SSBF*

Cross-sectional regressions of two firm performance measures (log of sales—Panel A and log of profits—Panel B) on measures of entrepreneur ownership shares and effort plus firm and entrepreneur characteristics are reported below. The data are from the 1993 *National Survey of Small Business Finances* and 1998 *Survey of Small Business Finances*. Since entrepreneurial effort is not reported in these surveys, effort is estimated based on the coefficients from an hours regression in the SCF applied to the NSSBF/SSBF values of those regressors. Estimations including this hours measure are referred to as two-sample instrumental variables (2SIV) estimations and are described further in Appendix B. Regressions are estimated using OLS with robust standard errors that account for residual heteroscedasticity and cross-correlations (*t*-statistics in parentheses). Regressions are also estimated via instrumental variables estimation (two-stage least squares). In the 2SLS regressions ownership is instrumented by dummy variables for how the firm was acquired (a founder dummy and a dummy for having inherited/been given the firm), and the entrepreneur's age and age squared. Overidentification tests and *p*-values are reported at the bottom of the table. All regressions include dummies for industry, year, entrepreneur gender, education, and ethnicity, as well as experience dummies. The coefficients on these variables are omitted from the table for brevity, along with the constant term. Panel C reports the results from the first stage of the instrumental variables regressions, along with *p*-values of the *F*-statistics on the joint significance of the instruments. Only the coefficient estimates on the instruments are reported for brevity.

Dependent Variable:	Panel A: ln(Sales)				Panel B: ln(Profits)		
Regression:	OLS	IV$^{(1)}$	2SIV		OLS	IV$^{(1)}$	2SIV
Own	-0.220	5.725			0.017	5.991	
	(-4.76)	(2.45)			(0.19)	(1.89)	
ln(Effort)			0.685				0.706
			(4.53)				(3.01)
ln(Assets)	0.411	0.517	0.430		0.431	0.533	0.435
	(43.16)	(11.58)	(35.87)		(30.29)	(9.19)	(22.02)
ln(Employees)	0.606	0.954	0.609		0.251	0.605	0.250
	(48.70)	(6.94)	(40.31)		(11.94)	(3.19)	(10.96)
Firm Age	0.004	-0.003	0.011		-0.003	-0.009	0.004
	(1.92)	(-0.69)	(2.88)		(-0.81)	(-1.63)	(0.80)
(Firm Age)^2	-0.000	0.000	-0.000		0.000	0.000	-0.000
	(-1.77)	(0.80)	(-2.22)		(0.18)	(1.26)	(-1.34)
Age	0.031				0.041		
	(3.14)				(2.13)		
(Age)^2	-0.000				-0.001		
	(-3.74)				(-2.56)		
Experience	0.016	-0.007			0.003	-0.019	
	(3.56)	(-0.52)			(0.33)	(-1.06)	
Founded			-0.096				0.026
			(-2.30)				(0.42)
Inherited			0.041				-0.044
			(0.54)				(-0.39)
R^2	0.808				0.445		
Observations	*6,187*	*6,187*	*6,222*		*4,842*	*4,842*	*4,855*
Over ID test		2.604	1.640			7.665	0.015
(*p*-value)		(0.457)	(0.651)			(0.053)	(0.999)
Panel C: 1st Stage Instrumented Regressions for Ownership							
IV Regression	Founded	Inherited	Age	(Age)^2	R^2	*p*-value	
(1) Own	-0.018	-0.010	0.002	-0.000	0.228	0.056	
	(-2.30)	(-0.68)	(0.68)	(-0.95)			

Figure 1:

Numerical Solutions for Entrepeneur Effort, Capital, and Labor Inputs as Ownership Share Varies Exogenously

Reported below are numerical solutions to the first order conditions for the production inputs in the augmented structural model of Section I.B. The entrepreneur sets the production inputs to solve the following maximization problem, equation (7):

$$\max_{\mu, K, L} \quad E(U) \quad = \quad E\left(\frac{1}{1-\gamma}\left(c^{\phi}(1-\mu)^{\theta}\right)^{1-\gamma}\right)$$

$$s.t.\ c \quad = \quad k + r\left(AK^{\alpha}L^{\beta}\mu^{\eta} - wL - pK\right) + zW.$$

For computational ease and to avoid a three-dimensional grid search, the level and productivity of capital and labor are set equal to each other (i.e., $\alpha = \beta$ and $K = L$). The baseline solution sets $\sigma = 0.50$, $\gamma = 5$, $zW = 100$, $\alpha = \beta = 0.4$, and $E(A) = 2$, and sets the utility function parameters to $\phi = 0.6$ and $\theta = 0.4$, the per unit costs of labor and capital (w and p) to 0.1, and the marginal product of the entrepreneur's effort η to 0.15. Variation in the solution for effort μ (Panel A) and for capital and labor inputs K and L (Panel B) are plotted as a function of exogenous changes in ownership share.
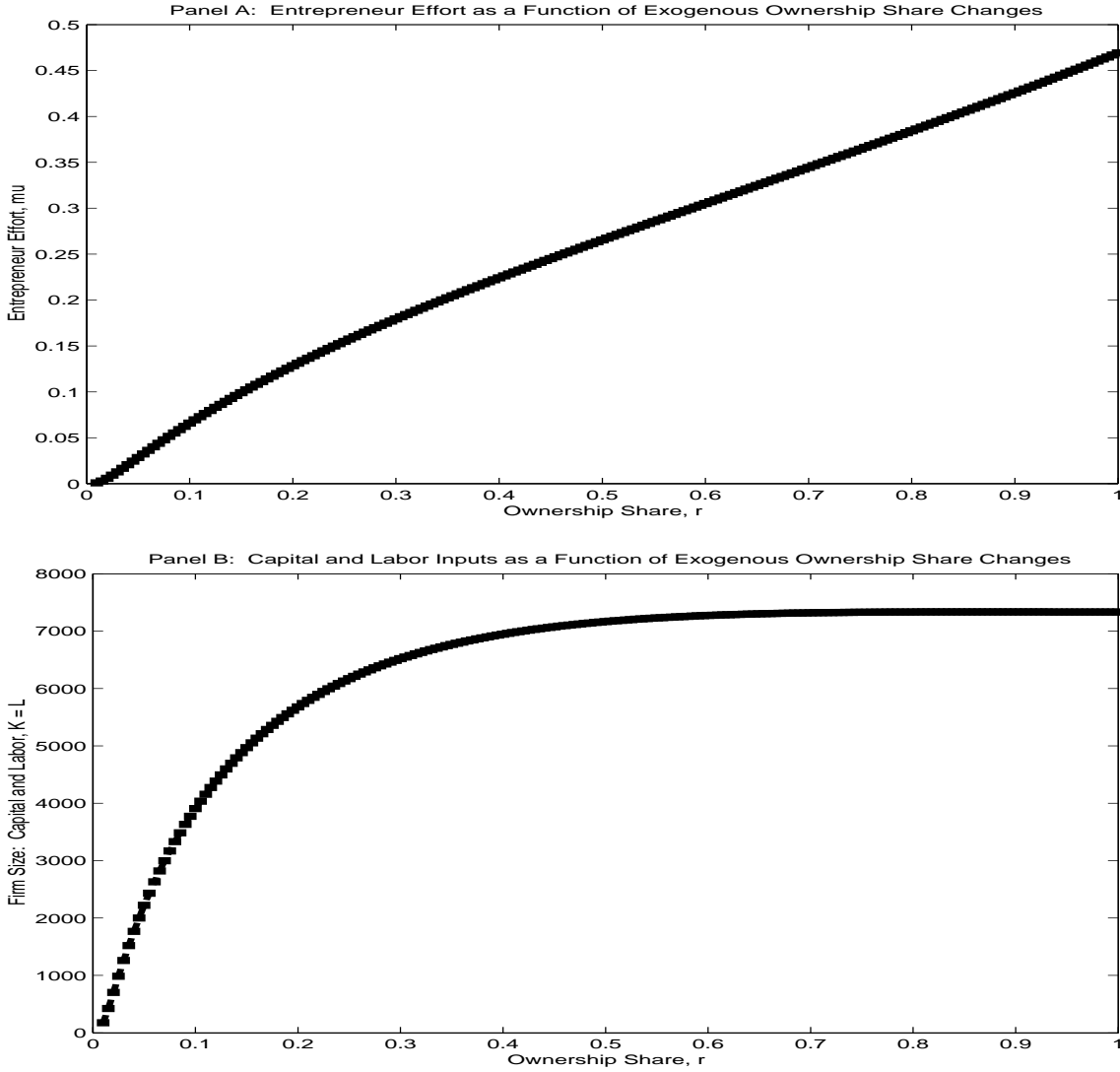
Figure 2:

Distribution of Principal Equity Ownership in Privately Held Firms

Using the 1989, 1992, 1995, and 1998 *Survey of Consumer Finances* and the *1993 National Survey of Small Business Finances* and *1998 Survey of Small Business Finances* from the Federal Reserve, the distribution of the fraction of equity owned by the entrepreneur (in the SCF)/the principal shareholder (in the NSSBF/SSBF) in privately held firms is plotted across all firms for each survey year.
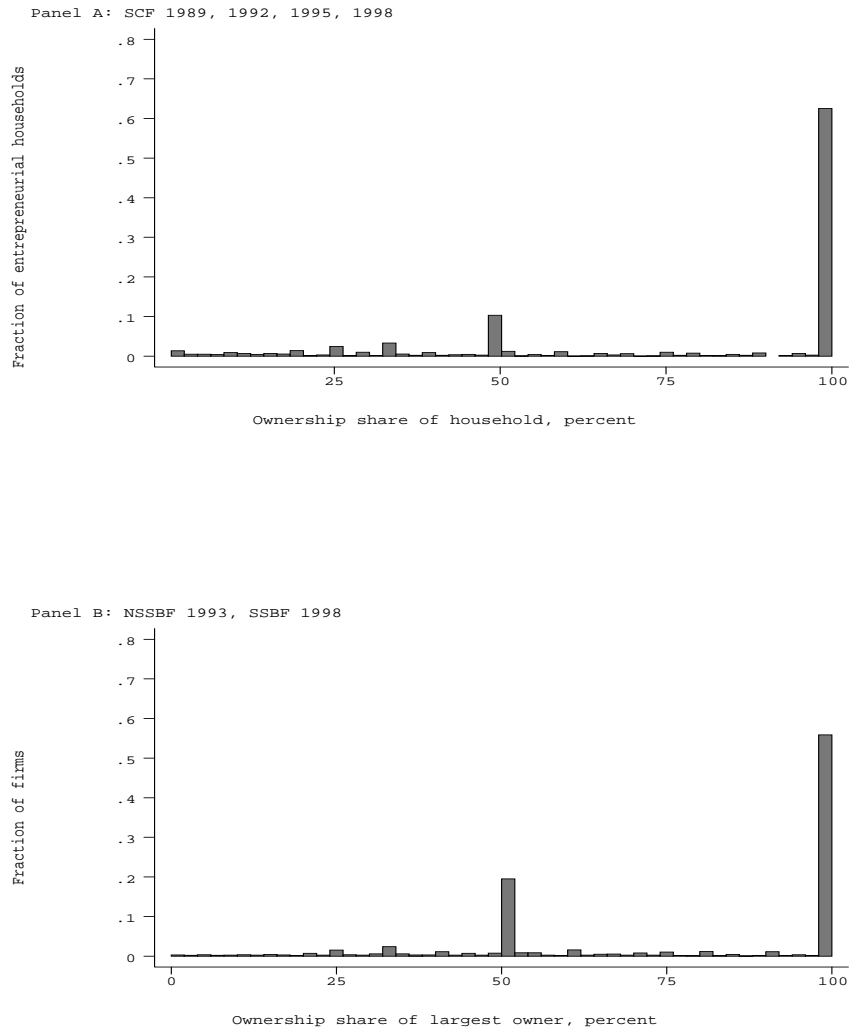

Panel A: SCF 1989, 1992, 1995, 1998

Panel B: NSSBF 1993, SSBF 1998

Figure 3:

Principal Equity Ownership in Privately Held Firms

Using the *1993 National Survey of Small Business Finances* from the Federal Reserve, the fraction of equity owned by the principal shareholder in privately held firms is plotted for various types of firms. The average fraction of principal ownership is plotted for deciles of firms sorted by number of employees, total asset value, and firm age. Also plotted is the ratio of firm total equity to total assets across the deciles. The deciles are calculated using NSSBF weights and firms are weighted within deciles according to the NSSBF weights. Since the first two deciles of numbers of employees are one, we treat the bottom 20 percent of firms as one category, plotting a single point on the graph. Therefore, there are only 9 number of employees categories, but there are 10 asset and firm age groups.